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## Original Research Article

# Prevalence of udder and teat affections in large ruminant in Beni-Suef and El-Fayoum provinces

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## ABSTRACT

This investigation was carried out on 5457 animals; among which, 3916 cows, 1531 buffaloes and 10 she-camels in Beni-Suef and Fayoum provinces. Animals were subjected to clinical examination to study the congenital and acquired udder and teat surgical affections. Clinical findings of affected animals were recorded. It has been found that the prevalence of teat and udder affections were: in cattle (19.87%; 778/3916), 141 (3.6%) had congenital anomalies, (hyperthelia 2.17%, leaker 0.38%, athelia 0.26%, pendulous udder 0.20%, hypermastia 0.26%, hypoplasia of mammary gland 0.13%, hyperplasia of teat 0.08%, teat obstruction 0.08% and fistula 0.05%) and 637 (16.267%) suffered from acquired affections (fibrosis 6.26%, mastitis 3.29%, pendulous udder 1.18%, edema 1.15%, fistula/wound 0.84%, teat obstruction 0.66%, teat stenosis 0.66%, ulcer/crack 0.64%, abscess 0.54%, hematoma 0.26%, seborrhea 0.23%, impetigo 0.18%, neoplastic growths 0.18%, udder gangrene 0.15% and teat gangrene 0.05%). In buffaloes (11.43%; 175/1531), 11 (0.72%) had congenital anomalies (hypermastia 0.59%, hyperthelia 0.07% and fistula 0.07%), and 164 (10.71%) had acquired affections (fibrosis 2.81%, ulcer/cracks 2.09%, mastitis 1.89%, seborrhea 1.44%, obstruction 0.91%, edema 0.46%, hematoma 0.33%, fistula/wound 0.26%, teat gangrene 0.26%, stenosis 0.13%, abscess 0.07% and impetigo 0.07%). In she-camels, no congenital anomalies were recorded with only one animal showed an acute mastitis and other had a teat orifice obstruction.

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## 1. Introduction

The quantity and quality of produced milk as well as the efficiency of its production is directly dependent on good health of cows and in particular cow's udder (Twardon et al., 2001).

Udder and teat affections always lead to economic loss in milk yield, loss in antibiotics-treated milk, possible loss of quarter if there is a necessity to dry off, and finally reflected on the economic value of the dairy animals, hence better knowledge on teat affections and abnormalities is found to be highly needed (Mahdy, 1998).

Adverse changes in the quality of milk, as well as increased costs for treatment and early culling of the animals make up the negative economic effect (Anderson and Pugh, 2002; Bergonier et al., 2003; Khan and Khan, 2006; Blowey and Edmondson, 2010).

So, the aim of this work is to evaluate the most prevalent abnormalities and surgical udder and teats affections in large ruminant in Beni-Suef and El-Fayoum provinces with special emphasis on the prevalence and causes.

## 2. Materials and methods

This study was conducted with 5457 large ruminants (3916 cows, 1531 buffaloes and 10 she-camels) in Beni-Suef and El-Fayoum provinces. Animals obtained from different farms and sporadic farmer animals. These animals were carefully examined for the detection of different udder and teats problems and abnormalities, either acquired or congenital affections.

### Diagnosis:

#### 1- History

Age, pregnancy, lactation, milking technology, housing, previous udder, teats disorders and previous udder and teats treatment were asked (Abd-Elhady, 1993).

#### 2- Signs

According to each anomaly or acquired affection clinical signs were recorded (AbdElhady 1993).

#### 3- Physical examination

Frightened animals were given tranquilizer xylazine Hcl 2% 0.05 mg/kg (1 cc Xylaject@ADWIA /400kg body weight) before examination. Physical examination of the udder and teats was done according to Nick Gray et al. (2009).

Inspection from near distance, standing beside the animal inspecting the forequarters from both sides then behind the animal to inspect hind quarters, the level of the eyes was adjusted to cope with the level of the udder, to detect abnormal size, superficial growths, wounds, swelling, accessory teats and skin lesions.

Palpation began with rolling of the teats between the tips of the fingers along the teat canal, this followed by deep palpation of each quarter with extended fingers while holding the udder with the other hand. Palpation was carried out starting from the tip of the teat upward to the base of the udder to detect hotness, consistency, peas or cords in the teat canal and any other abnormalities (Klaas et al., 2004). Milking and insertion of teat siphon help in detection of obstruction site and to check milk color, odor and consistency.

## Results

This study revealed that 954 animals had different udder and teat affections and represent 17.48% of the examined animals as following:

### 1) Udder and teats affections in cows:

The prevalence of udder and teats affections in cows was 19.87% (778/3916); 141 cows (3.6%) had congenital anomalies and 637 cows (16.27%) had acquired affections.

#### A- Udder congenital anomalies in cows.

This study recorded 3 types of udder congenital anomalies in 23 (0.59%) cows in the form of hypermastia (supernumerary quarters) in 10 cows (Fig.1), hypoplasia in 5 cows (Fig.2) and pendulous udder in 8 cows (Fig. 3) (Table 1).

**Table 1. Congenital anomalies of udder in cows.**

Congenital anomaly	Number	Prevalence (%)
Hypermastia	10	0.26
Hypoplasia of mammary gland	5	0.13
Pendulous udder	8	0.20
Total	23	0.59

**B- Teat congenital anomalies in cows.**

In 118 (3.01%) cows, teat anomalies were recorded, comprising: hyperthelia (supernumerary teats) in 85 cows (Fig.4), which located either posterior to the rear teats or in between the fore and rear teats, as it does not interfere with hand milking, leaker (incontinentia lactis) was recorded in 15 cows, athelia (absence of teat) occurred in 10 cows (Fig.5), hyperplasia of teat was in 3 cows (Fig.6), 3 cows had teat obstruction (Fig.7) and 2 had congenital teat fistula (Table 2).

**Acquired udder affections in cows:**

Out of 3916 examined cows 558 (14.25%) had acquired udder affections constituting 72.19% of total affected cows (Table 3).

Acute mastitis was found in 129 cows (3.29%) characterized by swelling (Fig.8), hotness, pain on touch and change in milk quantity and quality. The animal suffers from fever and in severe cases, lameness occurs, while in chronic mastitis the same picture is viewed with the presence of fibrosis (Fig. 9). Wounds were recorded in 33 cows (Fig. 10). Wounds in dry cows and superficial wounds had good results with treatment than deep wounds particularly, in lactating cows as milk oozes prevent healing and wound transformed into fistula.

**Table 5. Acquired udder affections in cows**

Acquired udder affections	Number	Prevalence (%)
Abscess	21	0.54
Edema	45	1.15
Fibrosis	245	6.26
Wound	33	0.84
Gangrene	6	0.15
Hematoma	10	0.26
Impetigo	7	0.18
Mastitis	129	3.29
Neoplastic growths	7	0.18
Pendulous udder	46	1.18
Seborrhea	9	0.23
Total	558	14.25

Seborrhea occurred in nine heavily lactating cows which were suffering of scald between the inner side of the thigh and lateral side of the udder (Fig. 11), the area was red, painful, and epidermis was sloughing with offensive odour. Pendulous udder recorded in 46 heavily lactating cows where the udder dropped down the hocks (Fig. 12). Impetigo characterized by presence of small papules which is itchy and painful on touch and hinders milking process (Fig. 13), were found in seven cows.

Wart-like neoplastic projections (Fig. 14) were found on the skin of udder and teat in seven cows. Udder gangrene (Fig. 15), udder oedema (Fig. 16), udder abscess (Fig. 17) and haematoma (Fig. 18).

**Table 2. Acquired teat affections in cows.**

Acquired teat affection	Number	Prevalence (%)
Teat obstruction	26	0.66
Stenosis	26	0.66
Teat gangrene	2	0.05
Ulcers and cracks	25	0.64
Total	79	2.02

**Table 3. Congenital udder and teats anomalies in buffaloes.**

Congenital anomaly	Number	Prevalence (%)
Hyper-mastia	1	0.07
Fistula	1	0.07
Hyperthelia	9	0.59
Total	11	0.72

**Table 4. Congenital anomalies of teat in cows**

Congenital anomaly	Number	Prevalence (%)
Hyperthelia	85	2.17
Leaker	15	0.38
Athelia	10	0.26
Hyperplasia	3	0.08
Obstruction	3	0.08
Fistula	2	0.05
Total	118	3.01

### Acquired teat affections in cow:

Acquired teat affections recorded in 79 cows, which were 26 teat obstructions (0.664%), 26 teat stenosis (0.66%), 2 teat gangrene (0.05%) and 25 teat ulcers and cracks (0.64%) (Table 4).

Acquired teat obstruction observed in four forms, the first form occurred in two cows, the teat was flaccid no milk came out and insertion of teat siphon stopped at the base of teat on forced penetration at this site milk came out but never came normally, the case was incurable (Fig. 19). In the second form there was a rounded movable structure in the teat canal and faint stream of milk came out occurred in eight cows (Fig. 20). In the third form, at the tip of the teat in 14 cows, the teat was engorged with milk without any signs of inflammation, on introduction of sterile 16 gauge injection needle milk flowed out, there was history of previous mastitis or FMD ulcer on the tip of teat in six cows. The last form was observed in two cows, in the first by palpation of the four teats were containing a cord like structure along the whole length of the teat canal and there was no milk.

Passage of faint stream of milk and milking time was prolonged were the complaint of 26 cows showed teat stenosis. Teat cracks and ulcers recorded in 25 cows in winter and during FMD attacks (Fig. 21), where it was painful to milk or touch of teat. Ulcers and cracks take long time up to six weeks to heal. In five cows ulcers healed by scab formation, but due to harsh hand milking the scab was removed and the wound became deeper resulted in fistula formation. Teat gangrene and sloughing of teat tip recorded in two cows having deep circular wound in the teats thereafter gangrene developed and sloughing occurred (Fig. 22).

### Udder and teats affections in buffaloes:

The total examined buffaloes were 1531 from which 175 animals suffered from udder and teats affections (11; 0.72% had congenital anomalies and 164; 10.71% had acquired affections).

#### a) Congenital udder and teats anomalies in buffaloes.

Recorded congenital anomalies in buffaloes (Table 5) were rare whereas one buffaloes had lactating extra quarters (Fig. 23) and the amount of milk comes from it nearly equals the normal

quarters. While one case of congenital fistula where milk escape from the upper part of the left rear teat (Fig. 24) also nine buffalo showed presence of extra non lactating teat (Fig. 25).

**Table 6. Congenital udder and teats anomalies in buffaloes.**

Congenital anomaly	Number	Prevalence (%)
Hyper-mastia	1	0.07
Fistula	1	0.07
Hyperthelia	9	0.59
Total	11	0.72

#### b) Acquired udder and teat affections in buffaloes.

The prevalence of acquired udder and teats affections in buffaloes was 10.71% (164/1531) (Table 6).

##### - Acquired udder affections in buffaloes

Only one buffalo had udder subcutaneous abscess (Fig. 26) which disappeared within 15 days after treatment was adopted. Edema recorded in seven buffaloes, it occurred three to five days before or after parturition, it take from five to seven days to subside except in one case where edema was severe it extended from perineum to umbilicus (Fig. 27). Acute mastitis recorded in 29 buffaloes where the udder was swollen, hot and painful to touch (Fig. 28). Neglected cases of mastitis ended in fibrosis (Fig. 29), which was recorded in 43 buffaloes, where quarter was shrink and loss its spongy texture and productivity.

Subcutaneous haematoma recorded in a buffalo having a swelling in the left fore teat (Fig. 30) which crepitated on palpation and blood came out on puncture, there was a history of a stroke by stick. Subcutaneous haematomas subsided after treatment. In parenchymatous haematoma milk came tinged with blood or red milk this occurred in 4 buffaloes. One buffalo suffered from impetigo (Fig. 31) and 22 suffered from seborrhea, signs of these affections disappeared within ten days of treatment.

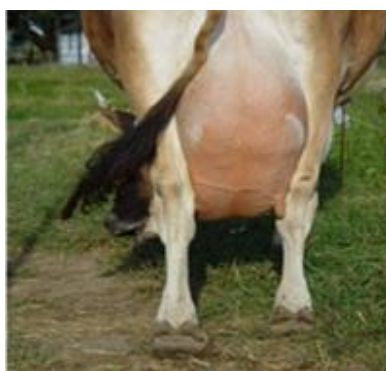
##### - Acquired teat affections in buffaloes

Teat ulcers and cracks were recorded in 32 buffaloes, 27 of them were suffer from foot and mouth disease (Fig.32). Recent teat wound healed after suturing in dry buffaloes, while old wound or that in lactating buffaloes ended in fistulae (Fig.33).

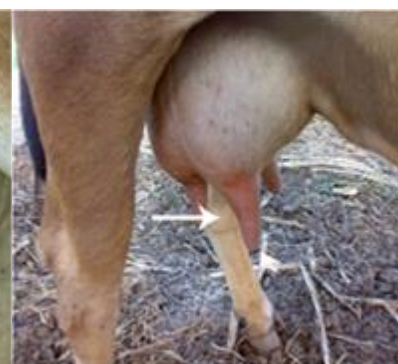
Teat gangrene recorded in four buffaloes (Fig. 34) after long-term mastitis where teat tip slough off.



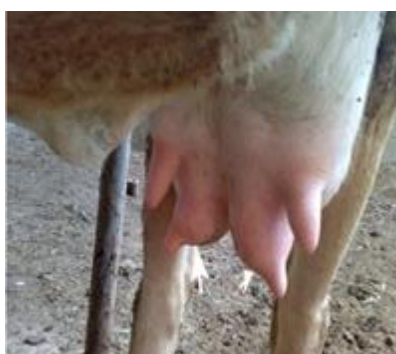
**Fig. 1. hyper-mastia in a cow    Fig. 2. Hypoplasia in a cow**



**Fig. 3. A pendulous udder    Fig. 4. Hyperthelia**



**Fig. 5. Athelia    Fig. 6. Hyperplasia of a teat**



**Fig. 7: Teat obstruction**





**Fig. 8. Acute mastitis**



**Fig. 9. Chronic mastitis**



**Fig. 10. Udder wounds**



**Fig. 11. Seborrhea**



**Fig. 12. Pendulous udder**



**Fig. 13. Impetigo**



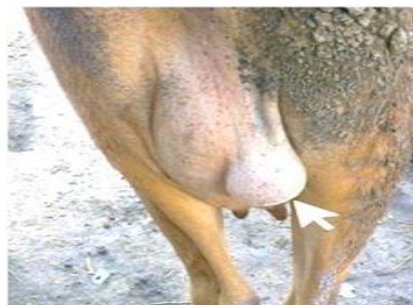
**Fig. 14. Wart-like projections**



**Fig. 15. Udder gangrene**



**Fig. 16. Udder oedema**



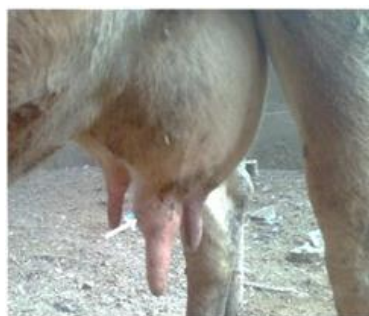
**Fig. 17: Udder abscess**



**Fig. 18. Udder haematoma**



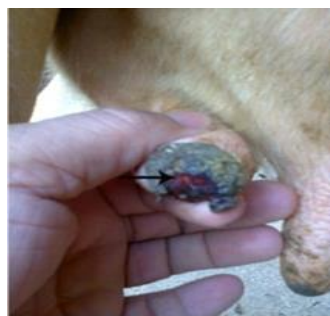
**Fig. 19. Teat obstruction**



**Fig. 20. Teat obstruction**



**Fig. 21. Teat ulcers**



**Fig. 22. Teat gangrene**



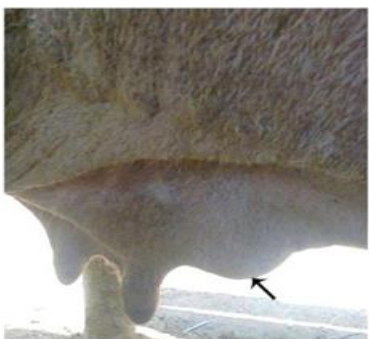
**Fig. 23. Lactating quarter**



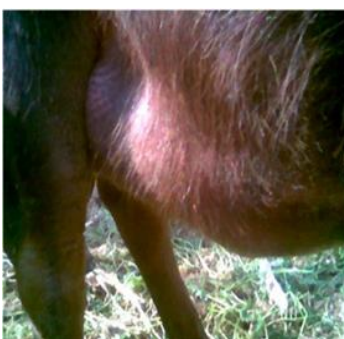
**Fig. 24. Congenital fistula**



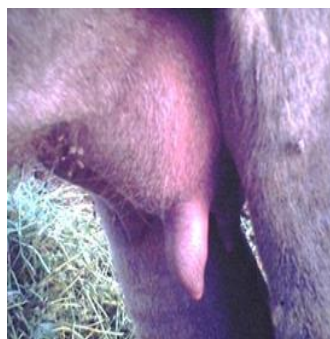
**Fig. 25. Extra lactating teat**



**Fig. 26. Udder subcutaneous abscess**



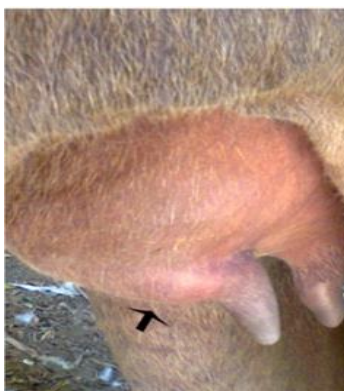
**Fig. 27. Udder edema**



**Fig. 28. Udder mastitis**



**Fig. 29. Mastitis**



**Fig. 30. Subcutaneous haematoma**

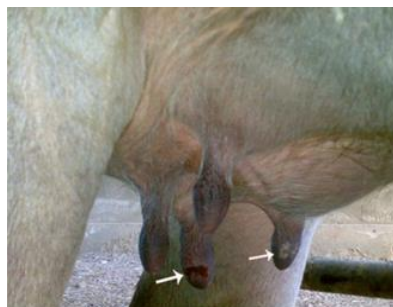


**Fig. 31. Impetigo**

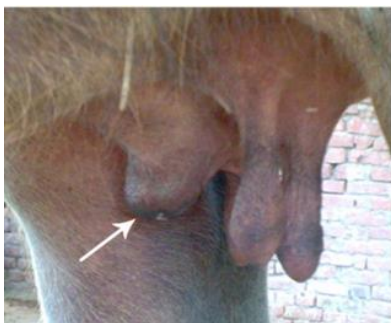




**Fig. 32. Teat ulcers**



**Fig. 33. Teat wound**



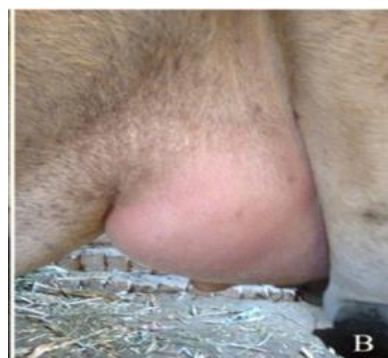
**Fig. 34. Teat gangrene**



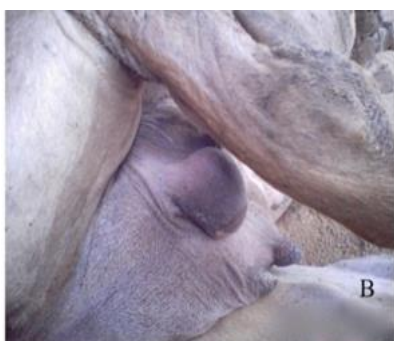
**Fig. 35. Teat stenosis**



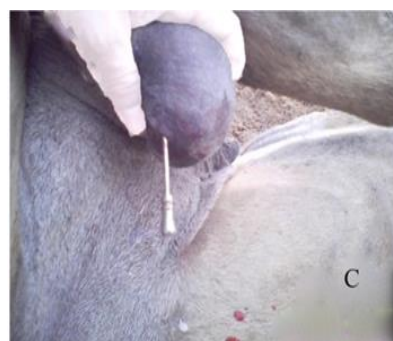
**Fig. 36. Teat obstruction**



**Fig. 37. Mastitis**



**Fig. 38. Teat obstruction**



**Fig. 39. Insertion of teat syphon**



Teat stenosis was found in two buffaloes where milk came out in faint stream, teat dilatation could be assumed by teat dilator (Fig. 35). Teat obstruction recorded in 14 teats, in form of obstruction between milk and teat cisterns in three cases, floating mass in two cases, cord like fibrosis of teat canal in four cases and obstruction of teat opening in five cases (Fig. 36) (Table 7).

#### Udder and teat affections in she-camels

Among 10 examined she-camels, only one was suffer from mastitis where the udder and teats were swollen and congested (Fig. 37), teat obstruction (Fig. 38) and insertion of teat syphon (Fig. 39).

**Table7. Acquired teat affections in buffaloes.**

Acquired teat affections	Number	Prevalence (%)
Teat obstruction	14	0.91
Stenosis	2	0.13
Teat gangrene	4	0.26
Ulcers and cracks	32	2.090%
Wound	4	0.26
Total	56	3.66

#### 4. Discussion

The present study revealed that the prevalence of udder and teat congenital anomalies in cows and buffaloes were 3.6% and 0.72%, respectively, while, the prevalence of acquired udder and teats affections in cows, buffaloes and she-camels were 16.27, 10.71 and 20.0%, respectively. The prevalence was lower than that found by Zaghlul (1991), Abd El-hady (1993) and Attia (2000) as a result of selection and culling over years.

Concerning hypoplasia of mammary glands, the prevalence was 0.13% in cows, coinciding with that recorded by Butz and Schmahlstieg (1955) Kung (1956), Heidrich and Renk (1967), Zaghlul (1991) and Attia (2000). The later attributed that to the failure of the organ to grow or neglected infection in puberty.

The prevalence of supernumerary teats was 2.17% in cows agreeing with that given by Heidrich and Renk (1967), Soliman (1988) and Zaghlul (1991). They stated that hyperthelia occurred with

considerable frequency in cows. Natural service inbreeding system helps the spread of the anomaly.

Hyperplasia of teat was met with in hand-milked cows (0.08%). Similarly, Attia (2000) mentioned that it was a common observation in machine milked cows with high yield. Congenital milk fistula rarely occur (O'connor, 1998). In this study, the prevalence of congenital milk fistula in buffaloes was 0.07%.

Leaker (incontinentia lactis) recorded in 15 low milk yield cows and as it is a common observation in heavy milking foreign breeds. Massage of the teat orifice with wet copper sulfate or injection of Lugol's iodine gave acceptable results (Espersen, 1976, Weaver, 1986).

Wounds of udders were recorded in cows at a rate of 0.84% while teat wounds recorded in 0.26% caused either by lying down on sharp object, trodden by other animal or butted by horn, appositional suturing reveal good result, escape of milk through sutures in lactating animals retarded healing process. Drying off milk to prevent fistula formation was recommended by Abd-Elhady (1993) and O'connor (1998).

Trauma is the first culprit causing haematoma parenchymatous recorded in cows (0.26%) and buffaloes (0.33%) which characterized by blood tinged milk. This was supported by Heidrich and Renk (1967), Frank (1981), Abd-Elhady (1993), Thomas et al. (2008) observations. They recommended an avoidance of rough squeezing of teat during milking.

Accumulation of fluid subcutaneous in the udder and sometimes extend to the umbilicus mostly occur in the period nearby parturition, incidence of occurrence is higher in foreign and cross bred animals, big fetus, insufficiency of udder circulation, pressure of gravid uterus, nutritional disturbance, calving season and genetics were among supposed causes of physiological edema which may subside without treatment few days after parturition (Lema et al., 1992; Radostits et al., 1994; Ramadan, 1994; Van der Kolk, 1998; Muhammad et al., 2005; Melendez et al., 2006). In our study, edemas recorded in 1.15% in cows and 0.46% in buffaloes.

Mammary gland skin cauliflower-like overgrowths were recorded in 0.18% in cows. Abd-Elhady (1993) met with 3 cases of udder papillomas in hand milking cows which appeared as a nodular, cauliflower like overgrowths and tightly adherent to the skin.

Necrotic dermatitis (seborrhea) was recorded in 0.230% heavy lactating Friesian cow. The skin epidermis of the inner side of thigh and the facing part of the udder were detached and dropped with offensive odour leaving red painful inflamed area. Blowey and Weaver (1991) attributed the condition to continuous pressure and friction, especially with presence of udder edema.

Teat ulcer was of high prevalence rate it was higher in buffaloes and cows, most recorded cases were occurred after rupture of FMD vesicles, the teats were sensitive to touch the animal suffer from severe pain during milking, these were in agreement with that found by Abd-Elhady (1993).

Stenosis of the teat orifice (hard milker) recorded in the present study in 0.66% in cows and 0.13% in buffaloes. Hickman and Walker (1980) mentioned that fibrosis of streak canal was the cause of teat stenosis, and teat dilator helped in the resolve of the problem.

## References

- Abd El-hady A, Azab A (1993). Studies on the prevalent surgical udder and teat affection in dairy farms. Thesis, M.V.Sc., 63–145. Cairo University.
- Anderson D, Hill B, Pugh D (2002). Diseases of the mammary gland. In: Sheep and Goat Medicine, WB. Saunders, Philadelphia, pp. 341–357.
- Attia AAG (2000). Surgical affections of the udder and teats in friesian cows. Thesis M.V.Sc. 54 – 105. Zagazig University, Benha branch, Moshtohor, Egypt.
- Bergonier D, Cremoux R, Rupp R, Lagriffoul G, Berthelot X (2003). Mastitis of dairy small ruminants. J. Vet. Res., 34: 689–716.
- Blowey RW, Weaver AD (1991). A color atlas of diseases and disorders of cattle. Chapter II, udder and teat disorders 177–188.
- Blowey R, Edmondson P (2010). Mastitis Control in Dairy Herds, 2<sup>nd</sup>, CAB International, Oxfordshire, p. 1–4.
- Butz H, Schmahlstieg R (1955). Erblicher Milchmangel als Folge einer Hypoplasie des Drusenparenchyms in Euter mit formal-und Kkausalgenetischer Analyse. Dt. Tierarztl. Wschr. 62, 463 – 468. Cited by Heidrich and Renk 1967.
- Espersen G (1976). Teat surgery. Bovine practitioner No. 11, 86–88.
- Fahmy L, Khamis Y, Hegazy A, Omar M (1981). Further studies on buffalo teat. Part 1 – congenital anomalies. Proceedings of 15 th arab veterinary medical congress.
- Frank ER (1981). Veterinary surgery. 7<sup>th</sup> ed. CBS publisher & distributors (India). 1<sup>st</sup> Indian ed.
- Ghanem ME, Nakao T, Yoshida C. (2011). Congenital Absence of a Teat in a Japanese Black Heifer. Case Reports in Veterinary Medicine, Article ID 897065, 3 pages doi:10.1155/2011/897065 Hindawi Publishing Corporation
- Hegazy A, Khamis Y, Fahmy L, Omar M (1982). Further studies on the buffalo teat. Part II – acquired affections. Assuit veterinary medical journal, vol. 10, No. 19.
- Huq QI, Singhal S, Gupta AK, Lattoo MZ, Gupta DK (2010). Conjoined functional supernumerary teats in a murrah buffalo College of Veterinary and Animal Sciences G.B. Pant University of Agriculture and Technology Pantnagar, U.S. Nagar-263145 (Uttarakhand) India Buffalo Bulletin (December 2010) Vol.29 No.4
- Klaas IC, Enevoldsen C, Vaarst M, Houe H (2004). Systematic clinical examinations for identification of latent udder health types in Danish dairy herds. J Dairy Sci., 87(5):1217–1228.
- Khamis MY, Saleh MS (1972). Mastectomy as a radical treatment of mastitis in doe and ewe. Egypt Vet. J., 20: 273–278.
- Khan MZ, Khan A (2006). Basic facts of mastitis in dairy animals: A review. Pak. Vet. J., 26: 204–208.
- Kumar RV, Sankar P, Veena P, Dhana Lakshmi N (2012). Athelia in a graded murrah she buffalo: a case report. Buffalo Bull., 31 (2): 70.
- Kung WB (1956). Weiterer Bietrag Zur kenntnis einer erblich bedingten Drusen-Aplasia und Hypoplasie in Eutervierteln des rinds. Vet. Diss. Zurich.
- Melendez P, Hofer CC, Donovan GA (2006). Risk factors for udder edema and its association with lactation performance on primiparous Holstein cows in a large Florida herd, U.S.A. Prev. Vet. Med., 76 (3-4): 211–221.

- O'Connor JJ (1998).  
Dollars veterinary surgery, general, operative,  
and regional fourth edition veterinary college of  
Ireland Ireland Dublin CBS publishers and  
distributors (India)
- Omar MSA (1973).  
Surgical affection of the buffalo udder.  
Thesis, M.V.Sc., faculty of veterinary medicine,  
Cairo University.
- Radostits OM, Blood DC, Gay CC (1994).  
Veterinary Medicine.  
8<sup>th</sup> ed. Bailliere Tindall, London. UK. pp. 615.
- Ramadan RO (1994).  
Surgery and radiology of the dromedary she-  
camel first edition college of veterinary medicine  
and animal resources king Faisal university  
kingdom of Saudi Arabia Al Jawad printing press
- Sagar PV (2009):  
Congenital absence of teats (athelia) in a buffalo.  
Buffalo Bull., 28 (3): 131–134.
- Soliman AS (1988).  
Bovine udder and teat affection in north Iraq.  
Alex. J. Vet. Sci., 4 (2): 473 – 482.
- Van der Kolk J.H. (1998).  
Persistent udder edema as a herd problem  
Vakgroep Inwendige Ziekten, Faculteit der  
Diergeneeskunde, Universiteit Utrecht Tijdschr  
diergeneesk. 1; 123(17):496–501.
- Weaver A D (1986).  
Teat surgery.  
Bovine surgery and lameness. 141–149.  
Blackwell scientific publication
- Witzig P, Rusch P, Berchtold M (1984).  
Characteristics, diagnosis and treatment of  
ruptured mucous membranes in the teat canal.  
Wesen, diagnose und behandlung von  
schleimhautabrissen in bereich des  
strichkanals. Deutsche tierärztliche wochenschrift  
91 (6): 219–222.
- Witzig P, Rusch P, Berchtold M (1984).  
Diagnosis and treatment of teat stenosis in dairy  
cattle with special reference to radiography and  
thelotomy. Vet. Med. Rev., 2: 123–132.
- Zaghlul A El-tabey (1991).  
Surgical affections and congenital abnormalities  
of bovine udder.  
Thesis of Veterinary Surgery, Department of  
Surgery, Faculty of Veterinary Medicine, Suez  
Canal University.