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Udder Morphology and Machine Milking Ability in Dromedary Camels

Shehadeh Kaskous
Department of Research and Development, Siliconform Company, Schelmengriesstrasse 1, D-86842 Türkheim, Germany,
Tel.:+49-8245-614, Fax: + 49-8245-3286
*Corresponding author email id: skaskous@siliconform.com

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Abstract **– Udder and teat morphology is an important factor in the machine milkability of Dromedary camels. However, the morphological characteristics of the udder and their relation to machine milkability in Dromedary camel have become of greater interest from farmers to researcher. The aim of this study was to evaluate the udder shape and udder measurements and demonstrate the beneficiary udder shape and udder measurements for machine milking in dromedary camel. The results has clearly shown that there are very strong differences with the udder and teat shapes as well as udder measurments between the dromedary camels, also within the herd in the farm. Therefore, healthy and well-shaped udders of Dromedary camels, suitable for machine milking, should have the following characteristics: a great volume (length, more than 35 cm, depth more than 25 cm), a basin shape and clearly defined teats, soft and elastic tissues, with palpable cisterns inside, moderate height, not surpassing the hock, teats of medium size (length 5-7 cm, diameter 2.5 cm), implanted near the vertical position. In order to achieve these properties of udder morphology, it must be considered in breeding programs and then the milking machine can have more efficient for the farmer and quarantees a better milk production with maintaining udder health.**

Keywords **– Dromedary Camel, Milking Machine, Udder Measurement, Udder Morphology, Udder Shape, Udder Traits.**

I. INTRODUCTION

The use of milking machine in the world is practiced by small numbers of camel keepers. Hand milking is the predominant milking system in camels. However there are some breeders in Russia [1], United Emirate Arabic [2], Tunisian [3], [4], Saudi Arabia [5], [6] and Netherlands [7] practicing machine milking in their herds.

There are several reasons hindering the use of milking machine in camels. Udder morphology has been described as an important factor in the machine milk ability of dromedary camels [6], [8], [9] and it is the most challenging factors to use of milking machine in the camel [2], [10], [11], which often not suitable for milking machine. To evaluate the udder morphology depends on two points, namely udder measurements and udder shape.

The use of objective measurements for the characterization of the dromedary camel udder and its relations with other productive traits has been undertaken by different authors [6], [8], but there is a paucity of data studying on udder shape of dromedary camel. Therefore, the aim of this study was to evaluate the udder shape and udder measurements and demonstrate the beneficiary udder shape and best udder measurements for machine milking in dromedary camel.

II. UDDER LOCATION AND SIZE IN DROMEDARY CAMELS

The camel udder is firmly suspended from the abdomen and located in the inguinal region. It consists of four quarters (Fig. 1). Each quarter is composed of 2 to 3 distinct glands each leading to separate streak canal within the respective teat [8], [12] (Fig. 2). According to the milk production of the camels, the udder at the good performance camels is characterized by a well-developed udder and milk vein [13]. Therefore the udder's weight of the lactating she-camel (1985 g) is heavier compared to the non-lactating she-camel (857 g) [14]. Morphological and anatomical studies of the camel udder indicated that the rear quarters are larger compared to the front quarters. For this reason more milk will be received from the rear quarter (55-58%) compared to the front quarter (42-45%) [15], [16]. Zayeed et al. [17] demonstrated that, there was a great variation in udder and teat size and length in the camel, which may be attributed to variable factors including, camel type, stage of lactation, parity number and disease. However, the shape of the udder can change according to camel-type, age and stage of lactation [10].

Fig. 1. Mammary gland in the inguinal region in dromedary camel (photo: kaskous)

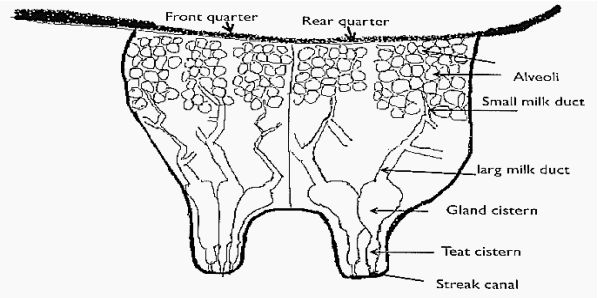

Fig. 2. Schematic form of a half udder in female camels (Drawing: Kaskous)

III. Udder Measurements in Dromedary Camels

Eisa et al. [18] observed that the udder and the teat measurements in typical features of the Arabi-Lahwee camel (*Camelus dromedarius*) in eastern of Sudan and the measuring parameters varied from animal to animal (see Table I).

Furthermore, it was found that udder and teat measurements have been subjected to change before and after milking. However, the measurements of the teat in the camels of Sudan were lower compared to above results and the average length of the teat was 3.2 cm, whereas the average diameter of the teat was 1.4 cm at the base and 0.8 cm at the apex and the distance between the front teats was greater than that in the hind teats [14].

Table I. Udder and teat measurements (cm) of Lahween camel in Sudan [18].

Parameters	Means	Parameters	Means
Udder Depth	16.9 ± 2.5	Fore teats diameter	2.1 ± 0.7
Udder circumference	91.4 ± 10.0	Rear teats diameter	2.5 ± 0.9
Udder size cm^3	1560 ± 388	Distance bet. Fore teats	13.1 ± 2.5
Udder height at fore quarters	111 ± 7.1	Distance bet. rear teats	10 ± 1.7
Udder height at rear quarters	110 ± 7.6	Distance bet. right teats	3.1 ± 1.8
Fore teats length	4.3 ± 1.4	Distance bet. left teats	3 ± 1.5
Rear teats length	4.4 ± 1.5		

Other studies showed that there was a great variation in teat length in camels and the average value was 7.1 ± 2.22 cm (minimum: 2.93 and maximum: 16.0 cm) and only 2 cm of the teat end fits into a commercial bovine liner. In addition, the teat undergoes significant volume changes during milking [19]. Abdallah and Faye [20] estimated some udder measurements of the Dromedaries camel in Saudi Arabia and showed some individual udder and teat length changes among types such that values ranged between 6-50 cm and 1-26 cm, respectively (see Table II), in addition to the positive correlation between teat Length and udder length ($r = 0.29$, $P<0.05$).

Table II. Mean udder measurements (cm) of 12 types of female Dromedaries camel in Saudi Arabia [20].

Type	Udder length	Teat length	Type	Udder length	Teat length
Hadhana	17	4.2	Saheli	16.7	5.1
Aouadi	15	4.7	Shaele	24.8	4.1
Asail	6.3	2	Shageh	17	5.2
Awrc	18.5	4.6	Sofor	22.7	4.3
Homor	25.6	4.7	Waddah	25.4	4.8
Majaheem	25	6.8	Zargah	22	4.5

These results showed that the dromedary camels are not phenotypically identical in Saudi Arabia and the difference in type is clearly indicated. According to their breeding characteristics, Wardeh [21] classified dromedary camels into four major classes: beef, milk, dual purpose and racing camels. Whereas, in Sudan camels were classified into 10 types based to the size of the udder and teat [22] (see Table III).

Table III. Phenotypic descriptions of camel types in Sudan [22]

Type	Udder size	Teat size	Type	Udder size	Teat size
Kenani	Large, medium	Large, medium	Kabbashi	Medium	Medium
Rashaidi	Large	Large	Maganeen	Large	Large
Lahawee	Medium, Large	Medium Large	Shanbali	Large	Large
Anafi	Rudi-mentary	Rudi-mentary	Maalia	Large	Large
Bishari	Rudi-mentary	Rudi-mentary	Butana	Medium	Medium

As shown in table III, the udder and teat size in the Kenani, Rashaidi, Maganeen, Shanbali as well as Maalia camels were large to medium and have a well-developed milk vein [22]. This explains their good performance and ability in milk production and may be classified as dual-purpose camels, but other types of camels have small size udders and teats.

Kausar et al. [23] have reported that the udder- and teats form changed markedly in dromedary camels in Pakistan with change the physiological status. In lactating females, the conformation of teats turned noticeably round at the tip. The length of teat varied significantly among the four different groups studied. The circumference and diameter of teat increased from tip to base. The morphometerical data revealed that teat length at maturity increased twice the size of immature heifer (7.95 ± 0.01 vs. 3.23 ± 0.26 cm). The Teat length increased ($P<0.05$) in lactating compared to non-lactating she camel, which might be attributed to the functional activity. The circumference at apex and mid points of teat decreased significantly ($P<0.05$) in non-lactating compared to lactating camels. However, the difference was statistically non-significant at base of teat (see Table IV).

Saleh et al. [24] found in the dromedary camels in Egypt that the fore-teats are placed further apart from each other than the hind ones and the teat in general is short and cone-shaped and somewhat flattened from side to side. Furthermore, it showed that both fore and hind teats are almost equal in length (see Table V).

Table IV. Morphological Observations (cm) on the teat of dromedary camels under different physiological conditions in Pakistan [23]

Parameter	Immature heifer	Mature heifer	Lactating	Non-Lactating
Teat length	3.23	7.95	11.8	8.83
Teat circumference (Apex)	2.45	6.00	6.48	3.40
Teat diameter (Apex)	0.77	1.90	2.05	1.09
Teat circumference (Mid)	3.31	7.06	7.91	6.08
Teat diameter (Mid)	1.05	2.24	2.51	1.93
Teat circumference (Base)	7.96	8.96	9.10	8.78
Teat Diameter (Base)	2.53	2.85	2.89	2.79

Table V. Length and Diameter (cm) of the teat of the Dromedary camel in Egypt [24]

Parameter		Right fore		Left fore		Right. hind		Left hind	
Teat length	A	2.38		2.40		2.41		2.38	
	Mi	1.6		1.6		1.5		1.2	
	Ma	4.0		4.0		3.1		3.3	
Teat diameter		*	**	*	**	*	**	*	**
	A	1.4	0.6	1.5	0.53	1.5	0.6	1.5	0.62
	Mi	0.9	0.3	0.9	0.2	0.8	0.4	1.0	0.4
	Ma	2.3	1.3	2.3	1.1	2.4	1.0	2.2	1.8

A: Average, Mi: Minimum, Ma: Maximum,*Base, **Apex

Eisa [8] found a great variations in udder and teat size and length in the she-camel according to different parity of animals (Table VI). These results seemed that the udder measurements increased with increasing parity order. It is known that the cow's udder increases with age, thereby the milk yield increases. Similar trend will be shown at camels and the highest milk yield in camels is shown up third lactation [25], [26]. Musaad et al., [27] showed that the highest average yield recorded in Saudi Arabia was for camels at sixth parity, whereas the highest weekly peak was at eighth parity, and highest persistency at fifth parity. Razig et al., [28] report that the highest milk yield (3168 kg) in the Kohi dromedary camel in Pakistan was demonstrated in the 5th parity (13.5 years), followed by 3051 kg in the 3rd parity (8.8 years) and 3010 kg in the 4th parity (11.5 years). However, the lowest milk yield (1566 kg) was produced in the 1st parity (4.5 years).

Table VI. Udder measurements (cm) in different parity of the dromedary camels in Sudan [8]

Parameter	3rd lactation	4th lactation	5th lactation
Udder depth	15.3 ± 1.3	16.0 ± 1.9	19.9 ± 1.1
Udder circumference	85.7 ± 7.8	91.1 ± 3.6	100.9 ± 8.9
Udder size (cm^3)	1311.8 ± 200.7	1454.9 ± 230.3	2018.6 ± 271.6
Udder height	114.5 ± 5.2	108.0 ± 3	105.8 ± 9.0
Fore teat length	3.4 ± 0.8	4.1 ± 1.0	6.0 ± 0.7
Rear teat length	3.4 ± 0.6	4.1 ± 0.9	6.1 ± 1.3
Fore teat diameter	1.7 ± 0.3	1.7 ± 0.2	3.1 ± 0.4
Rear teat diameter	1.9 ± 0.4	2.3 ± 0.4	3.7 ± 0.5
Distance between fore teat	12.9 ± 2.9	13.2 ± 1.2	10.2 ± 1.9
Distance between rear teat	9.9 ± 1.9	10.1 ± 1.1	10.2 ± 1.9
Distance between right teat	2.3 ± 1.3	3.3 ± 0.2	3.7 ± 2.9
Distance between left teat	2.6 ± 1.7	2.4 ± 0.6	3.7 ± 1.3

Eisa and Hassabo [16] reported that there is a clear difference between fore and rear udder-halves in dromedary camel according to the depth (P<0.01), height (p<0.05), teat diameter (p<0.01) and distance between teats (p<0.01). On the other hand showed, that the teat length was non-significant difference between the udders halves (see Table VII).

IV. The Relationship between Udder-and Teats Measurements and Milk Yield

Many studies indicated that there is very scary correlation between udder and teat measurements and milk yield in the dromedary camels.

Table VII. Fore and rear udder halves measurements (cm) in dromedary camels in eastern Sudan [16]

Measurements	Fore halves Udder	Rear halves udder
Depth	20.9 ± 0.75	13.1 ± 0.75
Height	110.9 ± 0.36	110.2 ± 0.36
Distance bet. Teat	13.2 ± 0.36	9.9 ± 0.36
Teat length	4.3 ± 0.18	4.4 ± 0.18
Teat diameter	2.1 ± 0.09	2.5 ± 0.09

Eisa et al. [18] showed that the udder depth, udder circumference, udder size and length of fore and rear teats were positively and significantly correlated with milk yield in dromedary camels, whereas the height of the udder measured for both fore and rear quarter was negatively but insignificant correlated with daily milk yield in camels. While, diameter of fore and rear teats were positively but insignificant correlated with daily milk yield. Similar results were showed by Ayadi et al. [6] as milk yield was positively correlated (P<0.05) with udder depth (r = 0.37), distance between teats (r = 0.57) and milk vein diameter (r = 0.28), whereas a negative correlation was found with udder height (r = -0.26) (see Table VIII).

Tab. VIII, Correlation between udder measurements (cm) and daily milk yield (kg) in dromedary camel in Sudan [18] and in Saudi Arabia [6]

Udder Measurements	Eisa et al. [18]	Ayadi et al. [6]
	Daily milk yield	
Udder depth	0.48**	0.37**
Udder circumference	0.46*	
Udder size (cm^3)	0.49**	
Udder length		0.33
Udder height at fore quarters	-0.37	-0.26**
Udder height at rear quarters	-0.30	-0.26**
Fore teat length	0.34*	-0.04
Rear teat length	0.36*	-0.21
Fore teat diameter	0.20	-0.12
Rear teat diameter	0.29	-0.31
Distance between front and rear teats	0.65*(R) 0.34*(L)	0.57**
Milk vein Diameter	0.30	0.28**

Significant: * (P<0.05), ** (P<0.01), R: Right, L: Left

V. Udder Shapes in Dromedary Camel and Assessment of Machine Milk Ability

In the field various forms of camel udder could be found and they varies with the breed (Type), management conditions (feeding management and housing), Country or climate, age, parity and stage of lactation [30] .

The udder quarters consist of the glandular tissue (alveoli), the milk ducts, the milk cistern and teat. In addition, fat and connective tissue make for the strength of the udder body. Desirable is a distribution of 70% glandular tissue and 30% connective tissue in the udder. This high milk production of the udder is guaranteed and at the same time given the necessary stability of the tissues and vessels. If the udder consists almost of a glandular tissue, it collapses after milking and is soft and pliable. Already after 3-4 lactations the tissue can sag and the udder changes his shape. In the worst case it is not or only partially suitable for machine milking. If, however, a very high percentage of fat and connective tissue present, it is called "*a meat udder*". This udder has a low milk yield, difficult to milking and hard after milking.

That the milk production under present intensive production conditions in camels can no longer be done by hand, but is carried out with machine milking. But because there is not an individual milk machine available for each she-camel, the udder of the she-camel must meet certain shape features, so that the animal can be integrated into the machine milking process.

Ayadi et al. [29] reported that globular shape (47.3) was the most common in Arabian dairy camels, followed by pear (34.3%) and pendulous (18.4%) shapes. Regarding the teats, conical was the most frequent shape (63.2% and 58.7% for front and rear teats, respectively) followed by cylindrical (26.4 and 32.5%, respectively) and blew-up (8.7 and 10.4%, respectively).

In this study the shapes of udders in dromedary Camels were evaluated and extended to four groups of udder shapes mainly based on shape, size, teat position and fits for machine milking according to cow udder scores.

In the following is the description of the udder shapes and assessment of suitability for machine milking.

A. First group: Desirable udder and teat shape (shape 1, figure 3)

a: the udder well formed, it can accommodate a large amount of glandular tissue. It is uniformly shaped. It has a vats or bowl shape. The teats are well established. The udder extends forwardly or so-called "*belly udder*" can expect high performance. During milking all quarters will be empty at the same time and rapidly. The teats make the application of machine milking very easy.

b: the udder shows spacious bowl-shaped udder. The same uniform quarters, clear veined, little hairy. It can expect high performance. The teats are vertically downwards (correct teat position) and they are medium long (4-5 cm). The form of the teats are conical basis then cylindrical barrel. The milking machine well attachable and at the same time all quarters will be empty (no bimodality) and rapidly.

a b

Fig. 3. Desirable udder and teat shape of dairy dromedary camels (shape 1)

B. Second group: Udder and teat shape with minor errors (shape 2, figure 4)

a: a medium soft udder, uniform quartering, short teats and conical teats from basis to tip end, the teats are not vertically downwards, Problems when attach the milking unit, air enters in the milking cups at the start of milking, at the same time all quarters will be empty (no bimodality) and rapidly.

b: the udder is called as "*ball udder*", uniform quartering, at the same time all quarters will be empty (no bimodality) and rapidly.

C. Third group: Udder and teat acceptable for milking machine (shape 3, figure 5):

a: a medium soft udder, extreme quartering of the udder or separate quarters from each other, unevenly strong quarter, the teats are medium and conical basis then cylindrical barrel,

a b

Fig. 4. Udder and teat shape with minor errors of dairy dromedary camel (shape 2)

milk machine well attachable, uniform udder emptying, milk cistern is through the teat slumped, each quarter of the udder is directly related to the teat without separation between them.

b: a medium soft udder, extreme quartering of the udder or separate quarters from each other, the teats are funnel and irregular, not the same size and shape (a rear left teat is long and thick), the milking machine well attachable, with some problems.

a b

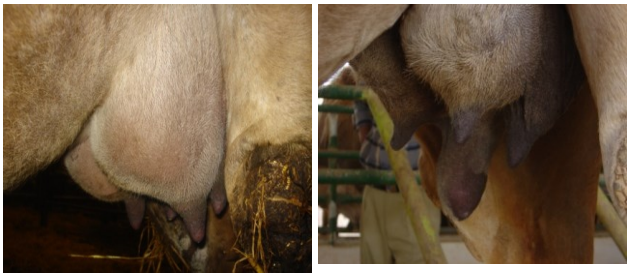

Fig. 5. Udder and teat acceptable for milking machine of dairy dromedary camels (shape 3)

D. Fourth group: Unwanted udder Forms for milking machine (shape 4, figure 6)

a: Udder shape is bad, irregular udder, forequarters weaker trained, connective tissue is weak, teats of the rear quarters are long and thick, this udder does not fit for milking machine and the milking machine is bad attachable (rear teats), uneven udder emptying.

b: Irregular udder, Rear quarters are formed weaker and the right one is desolated, the teats are irregular, this udder does not fit for milking machine and the milking machine is bad attachable (fore teats are long and thick), uneven udder emptying.

All udders and teats shape images were taken from different countries in the world (Kaskous)

a b

Fig. 6. Unwanted udder and teat Forms for milking machine of dairy dromedary camels (shape 4)

VI. CONCLUSIONS

To have a good camel udder for machine milking, the udder must have the following property: a large amount of glandular tissue, it has uniformly shaped and it has a vats or bowl shape, the teats are well established, medium long teats (5-7 cm) and the teat diameter is 2.5 cm and they have a correct position. This udder is good for milking machine and the cups are well attachable, all quarters are emptied rapidly at the same time.

REFERENCES

[1] A. Baimukanov, 1974 A machine milking in female camels. In: Proc.3rd Symp. Physiological principles of machine milking. Borovsk, USSR P: 67-68.

[2] U. Wernery, J. Juhasz and P. Nagy, 2004 Milk yield performance of dromedaries with an automatic bucket milking machine. Journal of Camel Practice and Research 11: 51-57.

[3] M. Ayadi, M. Hammadi, T. Khorchani, A. Barmat, M. Atigui and G. Caja 2009 Effects of milking interval and cisternal udder evaluation in Tunisian Maghrebi dairy dromedaries (Camelus dromedaries L.) Journal of Dairy Science, Volume 92: 1452-1459.

[4] M. Atigui, M. Hammadi and T. Khorchani, 2013 Effects of oestrus on milk yield and composition in Tunisian Maghrebi camels (Camelus dromedaries). Emirate Journal of Food and Agriculture, Volume 25 (4) P: 291-295.

[5] R. S. Aljumaah, E. M. Samara and M. Ayadi 2012 Influence of introducing machine milking on biothermal parameter of lactating camels (Camelus dromedaries). Italian Journal of Animal Science, Volume 11:e73: 414- 418.

[6] M. Ayadi, R. S. Aljumaah, A. Musaad, E. M. Samara, M. M. Abelrahman, M. A. Alshaikh, S. K. Saleh and B. Faye 2013 Relationship between udder morphology traits, alveolar and cisternal milk compartments and machine milking performance of dairy camels (Camelus dromedaries). Spanish Journal of Agricultural Research, Volume 11 (3): 790-797

[7] www. welt. de/wissenschaft/article 2013 Dromedar statt Kuh-Kamelmilch aus Holland.

[8] M. M. O. Eisa 2012 Udder Conformation and milk ability of she-camel (camelus dromedaries). LPA Lambert Academic publishing AG and Co kG.

[9] S. Kaskous and A. Fadelelmoula 2014 the challenge of machine milking in dromedary camel. Scientific Journal of Review Volume 3(12): 1004-1017.

[10] A. Tibary and A .Anouassi 2000 Lactation and udder diseases. In: Skidmore, J.A. and Adams, G.P. (eds): resent advances in camelid reproduction. Publisher International Veterinary Information Service (www.ivis.org).

[11] C. E. A. Albrecht 2003 Production of camel milk–first experiences in machine milking of dromedaries. Master thsis Agr., Göttingen, Germany.

[12] M. B. Nosier 1974 Histolical structure of the mammary glands of the one humped camel (Camelus dromerlarius). Indian Journal of Animal Science, Volume 43: 639-641.

[13] M. F. Wardeh and M. Al-Mustafa 1990 Camel breed types in the Arab countries north and West Africa. In: Arab symp. Camel Husbandry and diseases and methods of their control, March 24-26, 1990. Alger, Algeria. ACSAD/AS9/P 105/1990.

[14] H. I. Ismail 1986 Morphological, Morphometric and Histochemical observations on the udder of the camel (Camelus dromedarius). PhD thesis, faculty of agriculture, University of Khartoum, Sudan.

[15] R. Yagil 1982 Camels and camel milk. FAO Animal production and Health Paper Nr. 26, Rome, Italy: 14-19.

[16] M. O. Eisa and A. A. Hassabo 2009 Variations in milk yield and composition between fore and rear udder-halves in she-camel (camelus dromedaries). Pakistan Journal of Nutrition, Volume 8 (12): 1868-1872.

[17] A. A. Zayeed, A. B. Magdub, A. M. Shareha, A. El-sheikh and M. Manzally 1991 Camels in the Arab world. University of Omar El-Mukhtar, Libya, 1st edition (Arabic).

[18] M. O. Eisa, I. A. Ishag and A. M. Abu-Nikhaila 2010 A note on the relationships between udder morphometric and milk yield of Lahween camel (Camelus dromedaries). Livestock Research for Rural development Volume 22, (10), Article 188.

[19] J. Juhasz and P. Nagy 2008 Challenges in the development of a large-scale milking system for dromedary camels. In: P. Nagy, G. Huszenicza, and J. Juhasz, (Eds.) WBC/ICAR 2008 Satellite Meeting on Camelid Reproduction, 12-13 July. Budapest, Hungary.

[20] H.R. Abdallah and B Faye 2012 Phenotypic classification of Saudi Arabian camel (Camelus dromedaries) by their body measurements. Emirate Journal of Food and Agriculture, Volume 24 (3): 272-280.

[21] M. F. Wardeh 2004 Classification of the dromedary camels. J. Camel Science 1, ACSAD-Damascus: 1-7.

[22] I. A. Ishag, M. O. Eisa and M-K. A. Ahmed 2011 Phenotypic characteristics of Sudanese camels (Camelus dromedaries). Livestock Research for Rural development. Volume 23, (4), Article 99.

[23] R. Kausar, A. Sarwar and C. S. Hayat 2001 Gross and microscopic anatomy of mammary gland of dromedaries under different physiological conditions. Pakistan Veterinary Journal, Volume 21(4): 189-193.

[24] M. S. Saleh, A. M. Mobarak and S. M. Fouad 1971 Radiological, Anatomical and histological studies of the mammary gland of the

one-humped camel (Camelus dromedaries). Zentralblatt für Veterinärmedezin Reihe A, volume 18: 347-352.

[25] M. Y. Al-Saiady, H. H. Mogawer, B. Faye, S. E. Al-Mutairi, A. Musaad and A. Gar-Elnaby 2012 Some factors affecting dairy she-camel performance. Emirate Journal of Food and Agriculture, Volume 24 (1): 85-91.

[26] A. Raziq, M. Younas and M. A. Kakar 2008 Camel-a potential dairy animal in difficult environments. Pakistan journal of gric Science, Volume 45 (2): 263-267.

[27] A. Musaad, B. Faye and A. Abu Nikhela 2013 lactation curves of dairy camels in an intensive system. Trop. Anim. Health Prod. 45 (4): 1039-1046

[28] A. Razig, M. Younas, MS. Khan and A.Iqbal (2011) Milk production potential as affected by parity and age in the Kohi dromedary camel. Journal of camel Practice and Research 17(2):1-4.

[29] M. Ayadi, R. S. Aljumaah, E.M. Samara, B. Faye and G. Caja 2015 udder typology of Arabian dairy camels and proposal of a linear scoring system for assessing their udder traits for machine milking. Veterinaria, 42 (2), n. spec. Silk road camel: The camelids, main take for sustainable development: 110-112, 4th Conference of the International Society of camel research and Development/ ISOCARD 2015. 4, Almaty, Kazakhstan, 8 Juin 2015/12 jiun 2015.

[30] A. Musaad, M. Ayadi, A. Khalil, R. S. Aljumaah and B. Faye 2017 Udder and teat shape and the relationship with milk yield in camels (Camelus Dromedaries). Scholars Journal of Agriculture and Veterinary Sciences 4(10): 418-423.

AUTHOR'S PROFILE

Education

2000 Professor of Animal Physiology at the Department of Animal Science, Faculty of Agriculture Damascus University, Damascus, Syria.

1994-2000 Docent of Animal Physiology at the Department of Animal Science, Faculty of Agriculture Damascus University, Damascus, Syria.

1989-1994 Ordinary doctor of animal physiology at the Department of Animal Science, Faculty of Agriculture Damascus University, Damascus, Syria.

1984- 1989 Assistant at the institute of Physiology, veterinary Medicine, Leipzig university, Germany, ph. Dr. Agrar Doctor Agriculturarum.

1981-1983 Diploma Higher Study at the Faculty of Agriculture, Damascus University, Syria.

1977-1981 Study at the Faculty of Agriculture, Damascus University, Syria.

Professional Experience

Since 2012 Head of Department of Research and development of Siliconform Company GmbH, Germany (Experte in milking and milk production).

1989- 2012 Staff member for animal physiology (physiology of lactation), Department of Animal Science, Faculty of Agriculture Damascus university, Damascus, Syria