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The Development of udder Measurements during Gestation in the Maghrebi She-Camel

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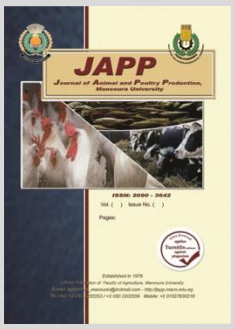

ABSTRACT

The udders were followed by monthly observation and measurement starting from the day of mating (Dm = 0d) in 13 pregnant Maghrebi she-camels. They were classified according to the multiple parities into three classes (1-2 parities), (3-4 parities) and (5-6 parities). These measurements included: udder length, udder horizontal circumference, udder semi-vertical circumference, udder depth, udder size, udder height, teat length, teat diameter, and distance between teats. In all different udder measurements, the differences were ascending, from (1-2 parities) to (5-6 parities). Those differences varied between significant and non-significant according to the convergence between the multiple parities classes. The measurements did not agree with each other on a constant rate of increase in growth rates. Each measure differed from the rest of the measurements in its rates of increase between multiple parities classes. The differences were very clear in some of the measurements, while they diminished in others. No significant increase was observed in udder measurements during gestation, which were divided into five stages. The results of the study indicated that the effect the multiple parities in the Maghrebi she-camels had a significant impact on the udder measurements of all Types, much greater than the effect of the stages of one gestation on those measurements.

Keywords: She-camel ages, Udder measurements, gestation order.

INTRODUCTION

Camel ! It is the animal with multiple and most mysterious characteristics, which can live without weariness in arid and desert environments and its ability to produce abundant and varied. Bedouins and shepherds depend on camels for their food sources of milk and meat, their clothing from camel lints, and also for work where they carry them, their luggage and their burdens. And camels donation did not stop in the field of Bedouins and shepherds only, but also developed and increased until it became a diversified economic resource for many countries that acquire it, especially in dairy production. The annual milk production from camels and dependence on it in consumption and manufacturing increased from 0.63 million tons in 1961 to 2.9 million tons in 2013 (FAO, 2017), so its production doubled 4.6 times in nearly fifty years only. Thus, camels occupied the fifth position globally in the production of milk after cows, buffaloes, goats and sheep (Faye and Bonnet,

2012).Camel milk has also become a prominent commercial activity in most of the countries that own camels, so the market potential for camel milk will develop significantly in the future (Faye, et al., 2014). Because of this important and huge production of milk, the udder is considered a very important organ of the dairy animal and its physiological and morphological characteristics are closely related to the performance of milk production (Kominakis et al., 2009). The mammary gland is unique among glands in that it is only functional during lactation, and for its importance, model measurements of udder dimensions and morphology have been added in selection programs for milking animals such as ewe (De la Fuente, 1996), buffalo (Prasad et al., 2010) and cow (Seykora and McDaniel, 1985). A camel's udder like a cattle udder consists of four quadrants, each with its own teat. These glands are grouped together in the udder structure, and several researchers have described the anatomy of the camel mammary gland (Smuts et al. 1987; Al-Ani 2004). Camels also were added to the main components of the dairy animal classification card for their distinguish in the well-developed mammary system (Mishra et al. 1978). Dairy camels are generally characterized by the development of milk vein and its prominence (Al-Ani 2004), in addition to the development of the udder (Wardeh and Ould Al-Mustafa 1990). The developed milk veins in camels may reflect a greater ability to secrete milk (Zayeed et al. 1991). Some data on camel udder shape has been shown to have an effect on milk production, and the morphological change before and after manual milking may indicate the possibility of milk secretion under an extensive production system (Eisa, et al. 2010). With all of the aforementioned characteristics of camels in addition to their ability to produce milk from poor feed more than any other type of milking animal (Wilson, 1997). A large variance was observed in the size and length of the udder and teat in camels, which can be attributed to various factors including the breed of camel, stage of lactation, number of parities and disease. The mammary gland grows with the growth of calves and its growth rate increases after puberty, and it accelerates greatly during pregnancy, and reaches its maximum development during the lactation period and subsides after the cessation of lactation (Lacasse and Prosser 2003; Delamaire and Guinard-Flament 2006).

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Age and lactation greatly affect on the mammary gland (Kausar et al, 2001). The aim of this study is to track and record the extent of growth and development in the udder measurements of the gradual ages and varying parities Maghrebi she-camels during gestation and in different stages of it.

MATERIALS AND METHODS

The current study was performed in the Department of Animal Biotechnology, Animal Production Research Institute, Egypt. The present work was carried out in the Private Camels Farm, Marsa Matrouh Governorate, located in the North of Egypt, closest area to the western border of Egypt. The studies initiated in November, 2018 and persevered until June, 2020.

- **Animals and Feeding:**

Thirteen healthy varying ages Maghrebi (Camelus dromedarius) she-camels belonged to three age divisions 3 - 5 years, 5 - 10 years and 10 - 20 years old respectively. The Overall means of the Maghrebi she-camels divisions body weight were 482 , 519 and 547 kg respectively. Ration per animal was offered twice daily at 8 a.m and 6 p.m. The ration was consisted of 7 kg of a forage mixture barley straw *(Hordeum vulgare)* and 3-4 kg of a commercial feed concentrate mixture (12% CP). The rations were augmented 1-2 kg of a commercial feed concentrate mixture (12% CP) daily for the pregnant she-camel. The additions were given as of the ninth month from the gestation. This process was submitted to farm customary regime without any methodological interfering in it.

- **Experimental design:**

The she-camels were pollinated in one estrus cycle for each, which included them during the extended period from last of January until beginnings of March. The thirteen pregnant she-camels were classified related to the multiple parities as follows: Six she-camels in (1-2 parities), four she-camels in (3-4 parities) and three she-camels in (5-6 parities).

- **Udder measurements:**

The she-camels udders were measured in a mating day (Dm = 0d), which was the initiation for this measurements. Each measurement was taken twice and calculated the average of the two reading before it was adopted as the base of the study data.

After that the pregnant she-camels udders were measured monthly The udder measurements of pregnant she-camels were recorded monthly until parturition.

Due to the stability of the udder measurements over several months, the pregnancy period was divided into stages according to the noticeable change in the udder measures, so that each stage includes from one month to several months of comparable measurements. The number of those stages was five stages distributed as follows: the first stage from the mating until the pregnancy examination. The second stage from the pregnancy examination until the ninth month after mating. The third stage during the tenth month from pollination. The fourth stage during the eleventh month after pollination. The fifth stage from the twelfth month and even parturition.

The udder measurements were as follows:(Length): It is the distance measured from one side between the anterior and posterior ligaments of the udder.(Depth): It is the average lateral vertical distances between the base of the four teats and the abdominal wall at the base of the udder.(Horizontal circumference): It is the sum of the measure of the horizontal surface distance of the right and left udder halves, from the anterior suspensory link between the anterior quadrants to the middle point between the posterior quadrants.(Udder Size): It is the product of multiplying the horizontal circumference of the udder in its depth (Maskovskaja, 1967). Semi-vertical circumference: It is the measurement of the vertical circumference of the udder surface between the anterior and posterior teats, starting with the abdominal wall at the base of the udder on one side, to the abdominal wall on the other. Udder height: is the vertical distance from the ground to the base of the teats, Classified into: {a- Fore quarter height}: is the average distance from the ground to the base of the front teats {b- Rear quarter height}: is the average distance from the ground to the base of the rear teats.(Teat length): It is the distance between the base of the teat and its tip, and it is Classified into: {a- Fore teat length}, {b- Rear teat length}.(Teat Diameter): It is the average thickness of the teat at the middle of the teat, and it is Classified into: {a- Fore Teat Diameter}, {b - Rear Teat Diameter}. (Distance between Teats): It is the distance between every 2 teat s from the middle point of the teat, and it is Classified: {a- Fore teats}, {b- Rear teats}, {c- Right teats}, {d- Left teats}.Teats measurements method was described by (Abdalla, et al, 2015). The units of measure used in udder measurements were the centimeter and square centimeter, and the instruments were the measuring tape and vernier caliper.

- **Statistical analysis:**

Data obtained were tabulated and statistically computed by SAS (SAS version 9.0, SAS Inst. Inc., Cary, NC). to have the analysis of variance procedure and Duncan's Multiple Range test to detect significant differences among means.

RESULTS AND DISCUSSION

The results of studying the effect of the multiple parities on the development of udder measurements during pregnancy and until parturition in Maghrebi she-camels are presented in Tables (1) and (2). From the results of the influence of the multiple parities on the development of udder measurements during gestation and until parturition in Maghrebi she-camels shown in Table (1), the increase in the udder length measurement generally appears among the three multiple parities classification within each stage of pregnancy, where the measure of udder length increased by increasing the multiple parities from (1-2 parities) to (5-6 parities), but the differences varied in terms of significance. The last 2 classes (3-4 parities) and (5-6 parities) increased significantly on the first (1-2 parities) and (5-6 parities) increased an insignificantly on (3-4 parities) during each stage of pregnancy. The multiple parities overall mean increased incrementally but insignificant with the progression in the stages of pregnancy. There were differences between the three multiple parities in the udder horizontal circumference within each of the five stages of pregnancy. Then it increased significantly with the elevation in multiple of

parities (from 1-2 parities to 5-6 parities) in all stages of pregnancy. The multiple parities overall mean increased clearly and regularly but insignificant with the progression in the stages of pregnancy. The comparable trend happened with the udder depth measurement within all stages, and the highest value of the udder depth was achieved with (5-6 parities) in the last stage of pregnancy (In a twelfth month after mating and even Parturition). The multiple parities overall mean increased insignificant with the consecution the stages of pregnancy. During each of the five stages of pregnancy, differences were noted among the three multiple parities classes in the udder semi-vertical circumference measurement. These differences were significant increasing from (1-2 parities) to (5-6 parities), and little differences were found in the multiple parities overall mean, which increased fewness with the consecution the stages of pregnancy, and the highest increasing was in the last stage. Also, differences were recorded among the three multiple parities classes in the udder size measurement, which changed in the same trend by the significant increasing with heightening in the multiple parities classes, or by fewness increasing in the udder size with the progression the stages of pregnancy.

Table 1. The variation (mean ± S.E) of Maghrebi she–camels udder Measurements (cm) among different parities during Gestation period.

Pregnancy stages	Multiple parities	Udder						
		Length	Horizontal circumference	Depth	Semi-vertical circumference	Size	Height	
							Fore quarter	Rear quarter
From mating until pregnancy examination	1-2parities	$18.91^{C} \pm 0.42$	$45.66^{C} \pm 1.50$	$18.50^{D} \pm 0.37$	$41.18^{C} \pm 1.15$	$849.16^{C} \pm 48.44$	$101.60^{A} \pm 1.63$	$100.20^{A} \pm 1.64$
	3-4parities	$22.97^{B} \pm 0.51$	$60.05^{B} \pm 1.84$	$22.72^{C} \pm 0.45$	$51.05^{B} \pm 1.40$	$1367.73^{B} \pm 59.33$	$99.47^{A} \pm 1.41$	$98.82^{A} \pm 1.42$
	5-6parities	$24.60^{BA} \pm 0.59$	$70.43^{A} \pm 2.13$	$24.46^{BA} \pm 0.52$	$64.96^{A} \pm 1.62$	$1723.55^{A} \pm 68.51$	$90.50^{B} \pm 1.15$	$90.01^{B} \pm 1.16$
	Overall mean	21.47 ± 0.731	55.80 ± 3.00	21.17 ± 0.75	49.70 ± 2.75	1210.50 ± 105.98	95.82 ± 2.57	95.07 ± 1.55
From pregnancy examination until ninth month after mating	1-2parities	$18.95^{C} \pm 0.42$	$45.85^{C} \pm 1.50$	$18.55^{D} \pm 0.37$	$41.28^{C} \pm 1.15$	$854.20^{C} \pm 48.44$	$101.56^{A} \pm 1.63$	$100.20^{A} \pm 1.64$
	3-4 parities	$23.05^{B} \pm 0.51$	$60.15^{B} \pm 1.84$	$22.80^{C} \pm 0.45$	$51.05^{B} \pm 1.40$	$1373.93^{B} \pm 59.33$	$99.42^{A} \pm 1.41$	$98.77^{A} \pm 1.42$
	5-6 parities	$24.60^{BA} \pm 0.59$	$70.40^{A} \pm 2.13$	$24.46^{BA} \pm 0.52$	$64.86^{A} \pm 1.62$	$1722.73^{A} \pm 68.51$	$90.60^{B} \pm 1.15$	$90.13^{B} \pm 1.16$
	Overall mean	21.51 ± 0.73	55.91 ± 3.00	21.22 ± 0.75	49.73 ± 2.75	1214.55 ± 105.98	95.84 ± 1.58	95.11 ± 1.51
During the Tenth month after mating	1-2parities	$19.16^{C} \pm 0.42$	$46.31^{C} \pm 1.50$	$18.76^{D} \pm 0.37$	$41.61^{C} \pm 1.15$	$871.82^{C} \pm 48.44$	$101.56^{A} \pm 1.63$	$100.20^{A} \pm 1.64$
	3-4 parities	$23.05^{B} \pm 0.51$	$60.15^{B} \pm 1.84$	$22.80^{C} \pm 0.451$	$51.05^{B} \pm 1.40$	$1373.93^{B} \pm 59.33$	$99.42^{A} \pm 1.41$	$98.77^{A} \pm 1.42$
	5-6 parities	$24.60^{BA} \pm 0.59$	$70.40^{A} \pm 2.13$	$24.46^{BA} \pm 0.52$	$64.86^{A} \pm 1.62$	$1722.73^{A} \pm 68.51$	$90.73^{B} \pm 1.15$	$90.28^{B} \pm 1.16$
	Overall mean	21.61 ± 0.73	56.13 ± 3.00	21.32 ± 0.75	49.88 ± 2.75	1222.68 ± 105.98	95.90 ± 2.57	95.18 ± 1.51
During the eleventh month after mating	1-2parities	$19.25^{C} \pm 0.42$	$46.60^{C} \pm 1.50$	$18.88^{D} \pm 0.37$	$41.78^{C} \pm 1.15$	$884.01^{C} \pm 48.44$	$101.56^{A} \pm 1.63$	$100.20^{A} \pm 1.64$
	3-4 parities	$23.22^{BA} \pm 0.51$	$60.55^{B} \pm 1.84$	$22.92^{C} \pm 0.45$	$51.22^{B} \pm 1.40$	$1390.21^{B} \pm 59.33$	$99.47^{A} \pm 1.41$	$98.87^{A} \pm 1.42$
	5-6 parities	$24.66^{BA} \pm 0.59$	$70.43^{A} \pm 2.13$	$24.53^{BA} \pm 0.52$	$64.93^{A} \pm 1.62$	$1728.14^{A} \pm 68.51$	$90.85^{B} \pm 1.15$	90.36 ± 1.16
	Overall mean	21.72 ± 0.73	56.39 ± 3.00	21.43 ± 0.75	50.03 ± 2.75	1234.56 ± 105.98	95.97 ± 2.57	95.25 ± 1.51
In a twelfth month after mating and even Parturition	1-2parities	$19.33^{C} \pm 0.42$	$46.93^{C} \pm 1.50$	$19.01^{D} \pm 0.37$	$42.01^{C} \pm 1.15$	$894.17^{C} \pm 48.44$	$101.50^{A} \pm 1.63$	$100.13^{A} \pm 1.64$
	3-4 parities	$23.35^{BA} \pm 0.51$	$60.80^{B} \pm 1.84$	$23.15^{BC} \pm 0.45$	$51.55^{B} \pm 1.40$	$1409.50^{B} \pm 59.33$	$99.25^{A} \pm 1.41$	$98.67^{A} \pm 1.42$
	5-6 parities	$24.80^{A} \pm 0.59$	$70.66^{A} \pm 2.13$	$24.63^{A} \pm 0.52$	$65.26^{A} \pm 1.62$	$1740.78^{A} \pm 68.51$	$90.73^{B} \pm 1.15$	$90.25^{B} \pm 1.16$
	Overall mean	21.83 ± 0.73	56.67 ± 3.00	21.58 ± 0.75	50.31 ± 2.75	1248.10 ± 105.98	95.83 ± 2.57	95.12 ± 1.51

***:Significantly differed, P<0.01**

Table 2. The variation (mean ± S.E) of Maghrebi she–camels teats Measurements (cm) among different parities during Gestation period.

Pregnancy stages	Multiple parities	Teats							
		Length		Diameter		Distance between teat			
		Fore	Rear	Fore	Rear	Fore	Rear	Right	Left
From mating until pregnancy examination	1-2parities	$3.10^{C} \pm 0.37$	$2.15^{B} \pm 0.29$	$1.50^{C} \pm 0.16$	$2.05^{D} \pm 0.19$	$9.93^{C} \pm 0.36$	$9.35^{C} \pm 0.38$	$1.90^{D} \pm 0.14$	$1.85^{C} \pm 0.11$
	3-4 parities	$5.40^{B} \pm 0.45$	$4.10^{A} \pm 0.36$	$2.65^{B} \pm 0.19$	$3.40^{C} \pm 0.23$	$12.50^{B} \pm 0.44$	$11.80^{B} \pm 0.47$	$2.75^{C} \pm 0.17$	$2.75^{B} \pm 0.14$
	5-6 parities	$6.93^{A} \pm 0.52$	$5.03^{A} \pm 0.42$	$3.46^{A} \pm 0.23$	$4.26^{BA} \pm 0.27$	$13.80^{BA} \pm 0.51$	$13.20^{BA} \pm 0.54$	$3.56^{BA} \pm 0.20$	$3.50^{A} \pm 0.16$
	Overall mean	4.69 ± 0.50	3.41 ± 0.39	2.30 ± 0.25	2.97 ± 0.28	11.61 ± 0.52	10.99 ± 0.52	2.54 ± 0.21	2.50 ± 0.20
From pregnancy examination until ninth month after mating	1-2parities	$3.11^{C} \pm 0.37$	$2.20^{B} \pm 0.29$	$1.55^{C} \pm 0.16$	$2.08^{D} \pm 0.19$	$9.93^{C} \pm 0.36$	$9.35^{C} \pm 0.38$	$1.90^{D} \pm 0.14$	$1.85^{C} \pm 0.11$
	3-4 parities	5.42BA ± 0.45	$4.12^{A} \pm 0.36$	$2.67^{B} \pm 0.19$	$3.40^{C} \pm 0.23$	$12.52^{B} \pm 0.44$	$11.80^{B} \pm 0.47$	$2.75^{C} \pm 0.17$	$2.75^{B} \pm 0.14$
	5-6 parities	$6.93^{A} \pm 0.52$	$5.03^{A} \pm 0.42$	$3.46^{A} \pm 0.23$	$4.26^{BA} \pm 0.27$	$13.80^{BA} \pm 0.51$	$13.20^{BA} \pm 0.54$	$3.56^{BA} \pm 0.20$	$3.50^{A} \pm 0.16$
	Overall mean	4.70 ± 0.50	3.44 ± 0.39	2.33 ± 0.25	2.99 ± 0.28	11.62 ± 0.52	10.99 ± 0.52	2.54 ± 0.21	2.50 ± 0.20
During the tenth month after mating	1-2parities	$3.16^{C} \pm 0.37$	$2.23^{B} \pm 0.29$	$1.60^{C} \pm 0.16$	$2.13^{D} \pm 0.19$	$9.93^{C} \pm 0.36$	$9.35^{C} \pm 0.38$	$1.90^{D} \pm 0.14$	$1.85^{C} \pm 0.11$
	3-4 parities	$5.42^{BA} \pm 0.45$	$4.12^{A} \pm 0.36$	$2.67^{B} \pm 0.19$	$3.40^{C} \pm 0.23$	$12.52^{B} \pm 0.44$	$11.80^{B} \pm 0.47$	$2.75^{C} \pm 0.17$	$2.75^{B} \pm 0.14$
	5-6 parities	$6.93^{A} \pm 0.52$	$5.03^{A} \pm 0.42$	$3.46^{A} \pm 0.23$	$4.26^{BA} \pm 0.27$	$13.80^{BA} \pm 0.51$	$13.20^{BA} \pm 0.54$	$3.56^{BA} \pm 0.20$	$3.50^{A} \pm 0.16$
	Overall mean	4.73 ± 0.50	3.46 ± 0.39	2.36 ± 0.25	3.01 ± 0.28	11.62 ± 0.52	10.99 ± 0.52	2.54 ± 0.21	2.50 ± 0.20
During the eleventh month after mating	1-2parities	$3.18^{C} \pm 0.37$	$2.25^{B} \pm 0.29$	$1.60^{C} \pm 0.16$	$2.13^{D} \pm 0.19$	$9.95^{C} \pm 0.36$	$9.35^{C} \pm 0.38$	$1.90^{D} \pm 0.14$	$1.85^{C} \pm 0.11$
	3-4 parities	$5.42^{BA} \pm 0.45$	$4.12^{A} \pm 0.36$	$2.67^{B} \pm 0.19$	$3.40^{C} \pm 0.23$	$12.55^{B} \pm 0.44$	$11.80^{B} \pm 0.47$	$2.77^{C} \pm 0.17$	$2.75^{B} \pm 0.14$
	5-6 parities	$6.93^{A} \pm 0.52$	$5.03^{A} \pm 0.42$	$3.46^{A} \pm 0.23$	$4.26^{BA} \pm 0.27$	$13.80^{BA} \pm 0.51$	$13.23^{BA} \pm 0.54$	$3.60^{A} \pm 0.20$	$3.50^{A} \pm 0.16$
	Overall mean	4.73 ± 0.50	3.46 ± 0.39	2.36 ± 0.25	3.01 ± 0.28	11.63 ± 0.52	11.00 ± 0.52	2.56 ± 0.21	2.50 ± 0.20
In a twelfth month after mating and even parturition	1-2parities	$3.18^{C} \pm 0.37$	$2.25^{B} \pm 0.29$	$1.68^{C} \pm 0.16$	$2.23^{D} \pm 0.19$	$10.00^{C} \pm 0.36$	$9.50^{C} \pm 0.38$	$1.96^{D} \pm 0.14$	$2.00^{C} \pm 0.11$
	3-4 parities	$5.42^{BA} \pm 0.45$	$4.12^{A} \pm 0.36$	$2.77^{B} \pm 0.19$	$3.52^{BC} \pm 0.23$	$12.77^{BA} \pm 0.44$	$11.95^{B} \pm 0.47$	$3.02^{BC} \pm 0.17$	$3.00^{B} \pm 0.14$
	5-6 parities	$6.93^{A} \pm 0.52$	$5.03^{A} \pm 0.42$	$3.56^{A} \pm 0.23$	$4.36^{A} \pm 0.27$	$14.06^{A} \pm 0.51$	$13.46^{A} \pm 0.54$	$3.83^{A} \pm 0.20$	$3.76^{A} \pm 0.16$
	Overall mean	4.73 ± 0.50	3.46 ± 0.39	2.45 ± 0.25	3.12 ± 0.28	11.79 ± 0.52	11.16 ± 0.52	2.72 ± 0.21	2.71 ± 0.20

***:Significantly differed, P<0.01**

The differences in both of two types of udder height (fore quarter height) and (rear quarter height) measurements were very small at the multiple parities classes and the multiple parities overall mean during the five stages of pregnancy. During each of the five stages of pregnancy, differences were observed among the three multiple parities classes in the udder height (both of two types), with an decreasing in their values from (1-2 parities) to (5-6 parities) at which the decreased significantly (5-6 parities) from the two precedent classes (1-2 parities and 3-4 parities). There were very slight differences in the multiple parities overall mean in both types of the udder height with the progress in the five stages of pregnancy.

As for the measures of teats under the influence of multiple parities during gestation and up to parturition in Maghrebi she-camels, is presented in table (2) and showing the following: There were notable differences in the value between two types of teat length (fore teat length) and (rear teat length), then the fore teat length was higher especially in the last multiple parities (5-6 parities) during all stages of pregnancy. Within each stage of pregnancy, the teat length of both types increased from first multiple parities (1-2 parities) to the last (5-6 parities). The increases were more clear and significantly among the multiple parities classes in the first stage pregnancy (From mating until pregnancy examination), then the multiple parities classes values were converging in other pregnancy stages particularly the last two classes (3-4 parities and 5-6 parities) in the both types of the teat length. The both types of teat length multiple parities overall mean increased slightly during two first pregnancy stages and they were steadying during last three stages. There were notable differences in the value between two types of teat diameter (fore teat diameter) and (rear teat diameter), then the fore teat diameter was lower during all stages of pregnancy.During each stage of gestation separately, the increases in the teat diameter valuewere significant initiation of (1-2 parities) to (5-6 parities). In both types of teat diameter multiple parities overall mean increased meagerly and regularly with the progression in the stages of pregnancy. There were far-reaching differences in the value among four types of distance between teats. The distances between fore teats were highest values, while the distances between left teats were the lowest during all stages of pregnancy. In the measurements of distance between teats with its four measures during each stage of pregnancy, the increase in their values initiated of (1-2 parities) to (5-6 parities) with different significance among the multiple parities in all types. The (5-6 parities) values were highest with different significance among four types of distance between teats. By comparing the stages of pregnancy it was shown that the increase in the four types of distance between teats in the multiple parities overall mean by progress through the stages of gestation was very limited, but it was more observed in the last stage of pregnancy. The udder of the Maghrebi she-camels and its measurement in its growth and development in general is subject to many factors that have the same effect on the udder of all types of camels, which have been proven by many researchers, the most important of which are age and the number of parities. (Kausar et al, 2001) noted that age and lactation significantly affect the mammary gland. The large variation in the size and length of the udder and teat in she-camels is attributed to various factors including the type of camel, the stage of lactation, the number of parities and disease (Lacasse and Prosser 2003; Delamaire and Guinard-Flament 2006).Overall mean of all udder measurements showed significantly ($P < 0.05$) gradual increase by advancing animal parity, being the lowest at 1-2 parities and the highest at 7-8 parities (Mostafa, et al, 2017). (Osman, 2006) found marked trend of increase in all udder and teat measurements by advancing parity, stage of lactations and age of camel. (EISA, et al, 2008) reported that, the majority of the udder measurements evaluated in the present study seemed to increase with increasing parity order. These results recorded by many researchers were not only related to the camel's udder, but were also mentioned about cattle and dairy animal. Kamieniecki (1980) reported that, in Polish Black – and – White low land cows, udder measurement increase with advancing parity (lactation) from parity 1 to parity 5. Tibary and Anouassi (2000) confirmed that, conformation of the udder can change according to breed, age and stage of lactation. (Zayeed, et al.1991) mentioned to a highly variations due to many factors such as breed, lactation stage, parity number and disease which can influence on the size and length of udder and teats. Age and the number of parities are closely related, so the number of parities increases with advancing age, both are indicators of the other, and their effect on the udder length was a significant effect ($P<0.01$), so the value of the udder length increased by advancing the age and the number of parities for the she-camel. Similar result was obtained by (Mostafa, et al, 2017), who notes that (udder length) is being with the highest values in she-camels with 7-8 parities. On the other hand, (Ayadi, et al, 2013) recorded in his study on another breed of she-camels a value of (udder length) nearly double what other studies mentioned. The effect of age and the number of parities on the udder Depth was significant ($P<0.01$), so its value increased with age and the number of parities, the highest value was in the fifth parity. These results agree in the trend and value with (EISA, et al, 2008; and Mostafa, et al, 2017), on the other hand, (Ayadi, et al, 2013) recorded in his study on another breed of she-camels a value of udder Depth nearly double what other researchers stated. The udder horizontal circumference was significantly affected by age and the number of parities, as its value increased with progress in both, and this was consistent with what was mentioned by (EISA, et al, 2008; Al-Saiady, et al, 2012; Abdalla, et al, 2015; Mostafa, et al, 2017; Ibrahim, 2018; Aboul-Rayat, 2019; and Ashour, et al, 2019), however, (Ashour, et al, 2019) mentioned that the highest value of the udder Horizontal circumference was in the fourth parity. The measurement of Udder Size is the product of multiplying the horizontal circumference of the udder in its depth, which were Suggested by (Maskovskaja, 1967) and set the unit of measurement (cm3), this needs to be modified. (cm3) This is a unit of measurement for volumes, while the Udder Size is the result of multiplying the udder Depth whose unit is a unit of lengths which is (cm) in the udder Horizontal

circumference and its unit is also a unit of lengths (cm), so it is more correct in the unit of value Udder Size is (cm2). The udder size was affected by age and the number of parities significantly, as its value increased with the progress in them, and the same trend was recorded by (EISA, et al, 2008). Age and number of parities had a significant effect on the udder semi-vertical circumference, as its value increased with progression in them, and the same trend with similar values was recorded by (EISA, et al, 2008). Age and the number of parities had a significant inverse effect on the Udder height of both types, as its value decreased with progression in age and the number of parities and its highest value was in the first parity and decreases thereafter, and the difference between its two types (Udder height of fore quarter) and (Udder height of rear quarter) is a very small difference, and this is consistent in trend with (EISA, et al, 2008). In terms of the value of this measure, higher values were recorded in other studies (EISA, et al, 2008; and Ayadi, et al., 2013) were carried out on other breed of she-camel. Age and the number of parities had a significant effect on the (teat length) of both types, as its value increased with age and number of parities, and the same trend with similar values were recorded by (EISA, et al, 2008; Mostafa, et al, 2017; Ibrahim , 2018; Aboul-Rayat, 2019; and Ashour, et al, 2019). And there was no significant difference between its two types (Fore teat length) and (Rear teat length), but researchers differed about which of the two types is greater, most studies recorded greater values were recorded in favor of (Fore teat length) (Ibrahim, 2018; Aboul-Rayat, 2019; and Ashour, et al, 2019), while researchers recorded equal values between them (EISA, et al, 2008;), on the other hand, others (Mostafa, et al, 2017) recorded greater values in favor of (Rear teat length). The values of the Teat Diameter of both types increased significantly with the age of the she-camel and the number of parities, and this is consistent in the trend and with similar values with (EISA, et al, 2008; Abd alla, et al, 2015; Ibrahim, 2018; and Ashour, et al, 2019).There was an insignificant difference between the two types of teat diameter which is the (Fore teat diameter), which is thicker than the (Rear teat diameter), but researchers differed about the significance of the difference between them. It indicated a non-significant increase in the value of the (Rear teat diameter) over the (Fore teat diameter) ((EISA, et al, 2008; Ayadi, et al., 2013; Abd Allah, et al, 2015; Ibrahim, 2018; and Ashour , et al, 2019). On the other hand, Eisa and Mustafa (2012) also reported that rear teat diameter was also found to be significantly different greater than fore teats (cited by, Ashour, et al, 2019). The values of (Distance between Teats) of its four types increased significantly with the progression of the she-camel in age and the number of parities, this is consistent in the trend with varying values with ((EISA, et al, 2008; and Mostafa, et al, 2017) whose studies included the four types (Distance between fore teat, Rear teat, right teat and left teat).the results also agreed with those who studied only two types (Distance between fore teat, and Rear teat) in trend with a small difference in values (Abd alla, et al, 2015; Ibrahim, 2018; and Ashour, et al, 2019). There were different variations in terms of significance and degrees among the four types according to the difference in age and parity, as well as according to the various studies.

CONCLUSION

The study found what confirms that the age, and the multiple parities in the Maghrebi she-camels have a significant impact on the udder and the development of its measurements, and these factors cause a significant change in the udder much greater than the effect of time that elapses during one pregnancy from the she-camel's life. And may be the supportive of the effect of these aforementioned factors on the development of udder, is the lactation period following pregnancy and parturition.

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تطور مقاييس الضرع خلال فترة الحمل فى النوق المغربى.

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تُبع الضرع بالملاحظة و القياس الشهرى بدأً بيوم التلقيح (Dm = 0d) فى 13 ناقة مغربى حامل صُنفت بحسب تعدد مواسم الولادة إلى ثلاثة رتب حمل هى (1-2 parities) و (3-4 parities) و (5-6 parities). إشتملت تلك القياسات على كل من : طول الضرع , محيط الضرع الأفقى, محيط الضرع العمودى, عمق الصرع, حجم الضرع، إرتفاع الضرع, طول الحلمة, سُمك الحلمة, المسافة بين الحلمات. فى جميع مقاييس الضرع على إختلافها كان الفروق متدرجة تصاعدياً من (1-2 parities) إلى (5-6 parities) بحسب تصنيف تعدد الولادات. كانت تلك الفروق تتفاوت بين المعنوية و عدم المعنوية بحسب التقارب بين رتب تعداد الولادات. لم تتوافق القياسات فيما بينها على نسبة زيادة ثابتةً فى معدلات النمو، فإختلف كل قياس عن باقى المقاييس فى معدلات زيادته بين رتب تعداد مواسم الولادة، فكانت الفروق شديدة الوضوح فى بعض القياسات بينما تضائلت فى البعض الأخرى. لم يُلحظ زيادةً معنويةً فى مقاييس الضرع خلال فترة الحمل ، التى تم تفسيمها إلى خمسة مراحل. أشارت نتائج الدراسة إلى أن تأثير العمر المتمثل فى تعداد مواسم الولادة السابقة فى النوق المغربى لها تأثير كبير على مقاييس الضرع بشتى أنواعها, أكبر بكثير من تأثير مراحل الفترة الزمنية لحمل واحد على تلك المقاييس.