

**MILK YIELD AND MILKING RATES OF THE
INDIVIDUAL QUARTERS OF THE UDDER
IN BUFFALOES, EGYPTIAN COWS AND FRIE-
SIAN COWS.**

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This experiment was carried out to study the milk yield and milking rates of the individual quarters of the udder in a group of 25 buffaloes, 18 Egyptian cows and 26 Friesian cows. The amount of milk drawn from each quarter was collected separately in a special separate quarter milking apparatus. The time spent for milking each quarter was measured in minutes to estimate the milking rates.

The fore quarters' contribution in milk yield was more pronounced at evening than at morning milkings. The fore quarters delivered 28.7, 39.8 & 38.2% of the total, morning milk yield in buffaloes, Egyptian and Friesian cows, compared to 32.2; 44.8 & 38.7 of the evening milk yield in the same animals, respectively.

The right rear quarter was the highest yielding part of the udder and also the second quarter in the order of milking.

The relative milk yields of the separate quarters of the udder remained fairly constant throughout the lactation period.

The milking rates of the fore quarters in the morning milkings were 1.0, 1.2 and 2.0 lb./min. in the case of buffaloes, Egyptian and Friesian cows, respectively compared to 0.9, 1.0 and 1.0 lb./min. in the evening milkings. The milking rates of the rear quarters at A.M. milkings were 1.4, 1.33 and 2.6 lb./min. in the case of buffaloes, Egyptian and Friesian cows, respectively compared to 1.3, 1.0 and 2.1 lb./min. in the evening milkings.

Strong correlations were found between milk yields and milking rates. The correlation coefficients at A.M. & P.M. milkings were +0.603 & +0.745 and 0.788 & +0.770 for buffaloes and Egyptian cattle, respectively.

Nearly all investigations had found that udder rear quarter's contribution in milk production more than the front ones. Matthews et al (1941) reported that the fore quarters gave on the average 38.8, 43.7 and 42.1 percent of the total udder yield for grade and registered and Jersey cows, respectively. Turner (1934) found very little differences in the yields from the right and left halves of the udder. Kudrashov (1954) found that these differences were greatest in Friesian cows, followed by the Khalmogor, Kastroma and Yarashavl breeds in decreasing order. Johnson and Korkman (1952) showed that the difference between the fore and rear quarter's production was highly significant where as that of the right and left halves of the udder was

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practically the same. Schalz (1929), Turner (1934), Matthews et al (1941) and Rabold (1958) pointed out the fixed proportion that existed between the quantities of milk secreted by the separate quarters of an individual udder from one milking to another, even though there were differences in the total yield between milkings. Skradel (1936) found that the right rear quarter was the highest yielding one.

Matthews et al (1941), Baxter et al (1950), Andreae (1954) concluded that there is a breed difference in the rate of milking of the different quarters of the udder. Beck et al (1951), Gregoire (1954) found a considerable variation in the rate of machine milking among different breeds and sire families within a breed. Stewart and Schultz (1958) reported that Guernsey cows showed a slower rate of flow of milk than Brown Swiss, Holsteins and Jerseys, and a variation in the rate of flow from 1.3 to 14.0 lb./min. was observed. Marathe and Whittlestone (1958) found that the average milking rate by machine in Indian water buffaloes was 1.4 lb./min. and ranged from 1.1 to 19 lb./min., while the rate for Jersey cows was 2.7 lb./min. Foot (1953), Andreae (1954, 1955 and 1958), Clough and Dodd (1957) and Sandvik (1957) found that milk was obtained at a rapid rate from high producing cows than from low producing ones. Dudd and Foot (1947) reported a significant relationship between milk yield and rate, being 0.640 between cows and 0.451 within cows. The rate increases with the increasing yield to about 13 kgs. but for higher yields there was no further increase in the probably because the teat orifice can be stretched only to a certain extent.

The relative yield of milk of the different quarters of the udder although has been thoroughly studied by many investigators in the case of the European breeds of dairy cattle, yet little or none is known in this consideration in the Buffaloes and Egyptian cattle. Also the stability of this rhythm of milking in the dairy breeds under tropical and sub-tropical conditions is not known. This work was carried out, to study the dairy characteristics of the Egyptian buffaloes and cattle in comparison to the Friesians. Milk yield of the whole udder, the yield of separate quarters and the rate of milking were the items of comparison. Such information are undoubtedly important for both the improvement of the dairy characteristics of the animals and in applying machine milking.

Material and Methods

A total number of 25 buffaloes, 18 Egyptian cows belonging to the Animal Breeding Department, Faculty of Agriculture, Cairo University and 26 Friesian cows raised on the Tahreer province farms were used in this study. The animals were hand milked twice a day at 7 A.M. and 3 P.M. A special device of separate four funnels, was used to collect the amount of milk drawn from each quarter of the udder separately at two periods, first from the beginning of milking till the stripping and second from this time till the end of milking. The quarters of the udder were milked according to the following order: right front, right rear, left front, and lastly the left rear one; stripping was carried out in the same order. The time required for milking of each quarter was measured to estimate the milking rates by dividing the quantity of milk drawn from each quarter by the corresponding milking time.

Results and Discussion

Individual Quarter Milk Yield

Friesian cows, udders showed close resemblance to the ideal udder, in which, each quarter gives one fourth of the total milk yield. Each fore quarter gave 20 percent of the milk yield compared to 30 percent for each rear quarter. On the other hand the buffaloes and Egyptian cows showed wide diversity between the fore and rear quarters and moreover, between the right and left ones (Tables, 1, 2, & 3). Therefore, it could be concluded that machine milking in the case of Friesian cows would be easier than with native animal selection towards the uniformity of the individual quarters production is very important for establishing modern practice of milking in local farms. Since the heritability of the front-to-rear quarters index is rather high, being about 0.75 (Johanson, 1958), therefore selection for better developed forequarters besides that depending on the milk yield will add to the good dairy characters which both buffaloes and Egyptian cows or still lacking. The present results agree with those of Mattick and Halbat (1929), Skrodel (1936) and Manner et al (1956). It also support the practice of judging the capacity of the udder by the size and soundness of the right rear quarter.

The contribution of the fore quarters was pronounced at afternoon milking compared to that of morning one especially in buffaloes.

It was observed that the relative milk yield of each quarter of the udder remained fairly constant through out the location period. which agrees with Scholz (1929), Turner (1934), Matthews et al (1941), and Rabold (1958). Therefore, the percentage of the relative quarters yield could be taken as a constant measure of the ability of milking for those quarters irrespective of the stage of lactation.

Milking Rates

The average milking rates for the entire udder were nearly the same in buffaloes and Egyptian cows, but remarkably lower than those in Friesian cows (Tables 4, 5 & 6). The milking rates of buffalos were very close to those reported by Marathe and Wittbestone (1958). They found that the average milking rates by machine in the Indian water Buffaloes was 1.4 lb./min. while it was 2.7 lb./min. for Jersey cows. Thomas and Anantakrishnan (1949), reported that the maximum rate of milking is an indication of the sphincter tension, this case may be the reason for the low rates in Egyptian buffaloes. A strong positive relationship was observed between milk yield and milking rates, the correlation coefficients at A.M. & P.M. milkings being +0.603 & +0.745 and 0.788 & +0.770 for buffaloes and Egyptian cows, respectively. This relation between milk yield and milking rates was confirmed by Andraee (1954, 1955 and 1958), Clough and Dodd (1957) and Sandivik (1959). Therefore the use of progeny testing indices calculated solely on the milk yield of a bull's daughters will automatically lead to selection for better milking rate.

In the present work, it was observed that the animals which were classed as fast milkers, milked rapidly from all quarters of the udder. It seems that the Egyptian cattle are well fitted to machine milking in view of the fairly equal yields and rates of the individual quarters of the same udder. Whatever changes in the milking rates were brought about by different conditions

prevailing at morning and afternoon milkings, or at different stages of lactation, the front and rear quarters were affected in very such the same manner. Highly milk yields, whether from separate quarters or for the entire udder, also required a little longer milking time than low yields. The average milking rates were lower in the fore than in rear quarters, as was expected because of the low relative milk yield in front than in rear quarters of the udder (table 4, 5, 6).

TABLE 1.—MILK YIELD AND PERCENTAGE OF QUARTER'S YIELD AT MONTHLY PERIODS FROM PARTURITION IN BUFFALOES

Month of lactation	Total udder yield (lbs.) ± St. error		Percentage of quarter's yield							
			Fore Quarters				Rear Quarters			
			Right		Left		Right		Left	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
1st	13.5±0.8	6.1±0.6	16.3	18.0	14.1	14.8	34.1	32.3	35.5	34.4
2nd	13.7±0.8	6.8±0.6	17.5	17.7	13.2	14.7	34.3	32.3	25.0	35.3
3rd	13.8±0.9	5.8±0.5	17.4	17.2	13.8	13.8	34.1	36.2	34.7	32.8
4th	18.8±0.7	6.0±0.5	15.6	16.7	12.5	13.3	36.7	35.0	35.2	35.0
5th	13.6±0.6	6.2±0.5	14.7	19.4	13.2	12.9	34.6	32.3	37.5	35.4
6th	13.1±0.8	6.2±0.5	15.3	17.7	12.2	14.5	34.3	32.2	38.2	35.5
7th	11.3±0.7	5.2±0.3	14.3	19.2	13.4	13.5	37.5	34.6	34.8	32.6
8th	10.2±0.4	4.7±0.4	14.7	19.1	15.0	36.3	31.9	36.3	36.3	34.0
9th	9.8±0.6	4.7±0.3	14.3	14.9	15.3	14.9	33.7	51.8	33.7	38.3
10th	9.9±0.7	4.2±0.3	15.2	16.7	14.1	16.7	39.4	35.7	31.3	30.9
Mean	12.2	5.6	15.6	17.9	13.1	14.3	36.1	33.9	35.2	33.9
Average daily yield	17.8		16.8		13.7		35.0		34.5	

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TABLE 2.—MILK YIELD AND PERCENTAGE OF QUARTER'S YIELD AT MONTHLY PERIODS FROM PARTURITION IN EGYPTIAN COWS.

Month of lactation	Total udder yield (lbs) ± St. error		Percentage of quarter's yield							
			Fore Quarters				Rear Quarters			
			Right		Left		Right		Left	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
1st	9.4±0.7	3.0±0.3	21.3	25.6	19.1	20.5	30.9	28.2	28.7	25.7
2nd	9.8±1.0	4.5±0.7	21.4	24.4	20.4	26.7	29.6	26.7	28.6	22.2
3rd	10.2±1.0	3.7±0.2	21.6	24.3	19.6	21.7	30.4	29.7	28.4	24.3
4th	9.4±0.7	3.6±0.1	21.3	27.8	19.1	19.4	30.9	27.8	28.7	25.0
5th	9.1±0.7	3.5±0.3	22.0	25.7	18.6	20.0	29.7	29.7	25.7	25.7
6th	9.8±0.9	3.7±0.3	21.4	27.0	19.4	21.6	31.6	24.3	27.6	27.1
7th	10.0±0.6	4.6±0.3	19.0	23.9	19.0	17.4	33.0	32.4	29.0	26.1
8th	0.9±0.6	3.8±0.3	21.3	26.3	18.0	18.4	32.6	29.0	28.1	26.3
9th	8.1±0.7	3.5±0.3	21.0	22.9	17.3	17.1	30.9	31.4	30.8	28.6
10th	8.3±0.7	3.2±0.2	21.7	21.0	16.9	15.6	30.1	31.3	31.3	31.2
Mean . .	9.3	3.8	21.5	26.3	18.3	18.5	31.2	28.9	29.0	26.3
Average daily yield . . .	13.1		23.9		18.4		30.0		27.7	

TABLE 3.—MEAN VALUES OF MILK YIELD AND PERCENTAGE OF QUARTER'S YIELD IN FRIESIAN COWS.

Animal No,	Total udder yield (lbs)		Percentage of quarter's yield			
	A.M.	P.M.	Fore quarters		Rear quarters	
			A.M.	P.M.	A.M.	P.M.
1	18.1	9.5	34.2	30.5	65.8	69.5
2	12.5	9.1	49.0	44.0	51.0	56.0
3	15.0	10.1	31.3	27.7	68.7	72.3
4	12.8	7.3	46.1	53.4	53.9	46.6
5	12.9	7.9	24.0	43.0	76.0	57.0
6	13.4	6.8	41.7	44.1	58.3	55.9
7	10.7	7.3	40.1	21.9	59.9	78.1
8	13.4	7.8	24.6	40.0	75.4	60.0
9	16.8	11.2	38.1	42.9	61.9	57.1
10	16.4	8.8	43.3	32.0	56.7	68.0
11	12.7	10.1	31.5	28.7	68.5	71.3
12	12.2	11.3	34.1	40.8	45.9	59.2
13	11.3	7.5	46.9	60.0	53.1	40.4
14	11.8	7.0	28.8	40.0	71.2	60.0
15	13.4	7.8	37.3	28.2	62.7	71.8
16	15.0	7.4	40.6	40.0	59.4	60.0
17	11.7	7.9	41.0	36.7	59.0	63.3
18	18.9	11.1	43.9	40.0	56.1	60.0
19	12.2	6.8	41.0	42.7	59.0	57.3
20	10.7	9.0	31.8	43.3	68.2	56.7
21	16.8	12.8	33.3	40.4	66.7	60.0
22	12.2	12.4	41.0	21.8	59.0	78.2
23	11.7	11.6	38.4	39.3	61.6	60.7
24	11.6	9.8	47.4	36.7	52.9	68.3
25	18.9	6.1	34.9	39.3	65.1	60.7
26	15.7	7.6	31.8	44.7	68.2	55.8
Mean . .	13.8	8.9	38.4	38.2	61.6	61.8

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TABLE 4.—RATE OF MILKING OF INDIVIDUAL QUARTERS AT MONTHLY PERIODS IN BUFFALOES

Month of lactation	Rate of milking (Ib./min)									
	Whole udder		Fore quarters				Rear quarters			
			Right		Left		Right		Left	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.N.	A.M.	P.M.	A.M.	P.M.
1st	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.9	0.7
2nd	1.1	1.0	0.9	0.7	1.0	0.7	1.3	1.1	1.1	1.1
3rd	1.1	0.9	1.0	0.7	0.8	0.8	1.3	1.0	1.2	1.1
4th	1.1	1.5	0.8	0.8	1.1	1.0	1.8	1.5	1.7	1.9
5th	1.1	1.1	0.9	0.9	1.0	1.6	1.2	1.6	1.3	1.2
6th	1.2	1.1	0.9	0.9	1.0	1.2	1.4	1.2	1.3	1.3
7th	1.6	1.4	1.0	0.9	1.1	0.8	1.9	1.7	1.5	1.9
8th	1.4	1.1	1.0	0.8	1.0	0.9	1.6	1.2	1.7	1.5
9th	1.2	1.1	0.9	0.8	1.1	1.0	1.4	1.3	1.5	1.4
10th	1.1	1.0	1.2	0.5	1.3	1.4	1.1	1.0	1.1	1.0
Mean	1.2	1.1	0.9	0.8	1.0	1.0	1.4	1.2	1.3	1.3

TABLE 5.—RATE OF MILKING OF INDIVIDUAL QUARTERS AT MONTHLY PERIODS IN EGEYPTIAN COWS

Month of lactation	Rate of milking (Ib./min)									
	Whole udder		Fore quarters				Rear quarters			
			Right		Left		Right		Left	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
1st	1.4	1.2	1.5	1.0	1.6	1.3	1.5	1.2	1.3	1.3
2nd	1.2	1.1	1.1	1.0	1.2	1.2	1.2	1.1	1.3	1.2
3rd	0.9	0.9	0.8	0.8	1.0	0.9	0.9	0.8	1.0	0.8
4th	1.2	0.6	1.1	0.6	1.4	0.6	1.1	1.0	1.3	0.7
5th	1.2	1.1	1.6	1.3	1.6	1.3	1.2	0.6	1.5	0.8
6th	1.2	1.1	1.2	1.3	1.6	1.2	1.0	0.7	1.1	1.1
Mean	1.2	1.0	1.2	1.0	1.4	1.1	1.2	0.9	1.3	1.0

TABLE 6.—MEAN VALUES OF THE RATE OF MILKING OF INDIVIDUAL QUARTERS AT MONTHLY PERIODS IN FRIESIAN COWS.

Animal No.	Whole udder		Rate of milking (lb./min.)							
			Fore quarters				Rear quarters			
			Right		Left		Right		Left	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
1	2.4	2.1	1.9	1.8	1.6	1.5	4.7	2.3	3.0	2.4
2	1.7	2.3	1.5	1.6	1.5	2.6	2.0	2.2	1.6	2.8
3	2.4	2.4	2.2	1.0	2.4	1.7	2.4	3.8	2.6	2.8
4	2.6	1.6	2.6	1.4	2.5	1.5	2.7	1.6	2.6	1.7
5	1.8	1.8	1.2	1.6	0.4	2.0	2.6	2.2	2.4	1.6
6	2.4	1.6	2.3	1.2	2.0	1.7	3.3	1.5	3.2	1.9
7	2.2	1.8	2.1	1.6	2.1	1.7	2.2	2.2	2.2	1.6
8	2.5	2.0	2.0	2.1	1.6	2.3	3.0	2.0	2.9	1.6
9	1.8	2.1	1.9	1.6	1.6	1.8	1.8	2.2	2.0	3.3
10	2.3	2.2	2.4	1.1	2.6	2.2	2.4	2.3	2.2	2.7
11	2.3	1.8	1.6	1.7	1.8	1.5	2.8	1.8	2.3	2.0
12	2.0	1.7	2.0	1.3	1.9	2.2	2.3	1.6	1.8	1.6
13	1.7	1.6	1.9	1.4	1.9	1.8	4.7	1.2	1.7	1.8
14	2.2	1.9	2.1	1.4	1.8	3.4	2.5	2.0	2.1	2.2
15	2.1	1.7	1.8	1.3	1.7	1.8	2.6	1.8	2.3	1.8
16	2.2	2.0	2.1	1.2	1.8	2.8	2.2	2.6	3.3	2.4
17	2.1	2.3	2.1	8.2	1.7	2.2	2.5	3.9	2.0	2.8
18	2.7	1.7	2.5	1.1	2.3	2.2	3.0	1.6	2.9	2.1
19	2.2	1.2	1.3	0.9	2.4	1.5	3.1	1.5	2.2	0.9
20	2.5	1.5	2.0	1.2	2.2	1.4	3.1	1.1	2.5	1.6
21	2.5	2.5	2.2	2.1	2.2	2.5	2.5	2.8	3.2	2.7
22	2.0	3.2	2.0	1.1	1.9	2.3	1.7	2.3	2.5	2.8
23	2.6	2.1	1.8	2.2	2.6	2.1	2.7	3.2	3.2	2.1
24	2.0	2.1	2.7	1.8	2.2	1.9	2.4	1.3	1.6	3.6
25	2.4	1.7	2.0	1.3	2.4	1.6	3.9	1.8	2.3	2.2
26	2.9	1.9	2.5	1.8	1.6	1.6	3.9	2.4	3.4	2.0
Mean	2.3	1.9	2.0	1.5	2.0	1.9	2.8	2.1	2.4	2.2

It should be taken into consideration that although hand milking is the common practice in this country yet, with the influx of farm mechanization, and the increase and availability of electrical current resources, the use of machine milking will be the common feature in the dairy husbandry in this country. It seems that the application of machine milking to either buffaloes or cattle will meet no serious difficulties as it was thought before. The low level of milk production as well as the low milking rates are not hindering factors to this procedure.

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محصول اللبن ومعدلات الحليب للأرباع المختلفة في ضرع الجاموس والبقر المصرى والفريزيان

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المخلص

اجريت هذه الدراسة على قطيع من الجاموس والبقر المصرى بمزرعة قسم تربية الحيوان بكلية الزراعة بالقاهرة وكذا الفريزيان بمديرية التحرير خلال الفترة من ١٩٥٨ - حتى ١٩٦٢ . والفرص من التجربة دراسة محصول اللبن ومعدلات الحليب في الأرباع المختلفة من الضرع . وقد شملت الدراسة ٢٥ جاموسة ، ١٨ بقرة مصرية ، ٢٦ بقرة فريزيان . وقد تبين من الدراسة ما يلى :

كانت النسبة المثوية لمحصول الأرباع الامامية للضرع في الصباح والمساء على التوالي كما يلى :

٢٨٧ ، ٣٢٢٪ للجاموس و ٣٩٨ ، ٤٤٨ للبقرة المصرى ، ٣٨٢ ، ٣٨٧٪ للفريزيان .

اعطى الربع الخلفى الايمن محصولا من اللبن اكبر من بقية ارباع الضرع ، كما كان الثانى في ترتيب الحليب .

كان المحصول النسبى للأرباع الامامية في حلبه المساء اعلا منه في حلبه الصباح لنفس الضرع وفي الحيوان لواحد .

كانت الكفاءة الانتاجية للأرباع الامامية في الجاموس اقل كثيرا منها في البقر المصرى والفريزيان ولذلك فعند الانتخاب يجب ان يلاحظ ارتفاع الانتاج النسبى لهذه الأرباع .

كانت معدلات الحليب للأرباع الامامية من الضرع في الصباح والمساء على التوالي كما يلى :

١٠٠ ، ٩٠ رطل في الدقيقة للجاموس ، ١٠١ ، ١٠٠ رطل للبقرة المصرى ، ٢٠٠ ، ١٧٠ رطل معدلات للفريزيان - معدلات الحليب للأرباع الخلفية في الصباح والمساء على التوالي كما يلى : ١٠٤ ، ١٠٣ للجاموس ، ١٠٣ ، ١٠٠ رطل للبقرة المصرى ، ٢٠٦ ، ٢٠١ رطل في الدقيقة للفريزيان .

وجدت علاقة موجبة معنوية بين محصول اللبن في الضرع ومعدلات الحليب . وقد تفسر هذه العلاقة التباين في معدلات الحليب بين الأنواع المختلفة من الحيوانات وبين أفراد النوع الواحد وكذا بين الأرباع المختلفة للضرع الواحد بل وبين حليب الصباح والمساء . وكانت قيمة معامل الارتباط بين حليب الصباح والمساء هي ٠.٣٦٠٣ ، ٠.٧٤٥٠ ، ٠.٧٨٨٠ ، ٠.٧٧٠٠ في الجاموس والأبقار المصرية على التوالي .