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Milk yield and composition of Chios and Farafra sheep under subtropical Egyptian conditions

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Abstract
Chios ewes produced 0.703, 49.90, 16.77, 66.67 kg in 96.15 days, while, Farafra ewes produced 0.675, 45.96, 13.43, 59.40 kg in 87.93 days, for daily milk yield (DMY), milk yield pre-weaning (MBW), milk yield post-weaning (MAW), total milk yield (TMY) and lactation length (LL), respectively. Breed differences were significant (P< 0.01) with TMY and LL. Ewes reared twin lambs were produced significant (P< 0.01) much milk than those ewes reared single lambs. Ewes lambed at the spring season had greater milk yield compared to ewes lambed at the summer season and autumn season. Ewes of (> 4 - ≤5) years old showed relatively higher milk yield than younger or older ones. Fat% averaged 6.17 for Chios and was significant (P< 0.01) higher than 5.59% for Farafra milk. Also, Chios had slightly higher (TS %) than Farafra (16.04 *vs.* 15.59%), respectively. Protein content for Chios and Farafra milk differed significant (P< 0.01) and averaged 5.62 and 5.31%, respectively. Chios ewes had higher milk energy (4.59 MJ/kg) than Farafra once milk energy (4.34 MJ/kg). The autumn lambing ewes had a significant and higher fat%, TS% and milk energy (MJ/kg) than both summer lambing and spring season.

Introduction
Sheep represents an important part of the agricultural economy of Egypt with an estimated 4,672,000 heads. In Egypt, sheep are non-dairy, but produced 93,000 ton milk yearly (FAO, 2004), a new demand on sheep milk cheese is developing either due to the increased tourism or to changing consumers performance. Moreover, efficiency of milk yield is well known to be the base for good lamb performance. In Egypt, the potentiality of the local breeds of sheep or milk production is not clearly identified (Galal et al., 2002). The aim of this study was to evaluate milk yield and composition of Chios and Farafra sheep.

Material and Methods
Chios flock was imported by Ministry of Agriculture at the end of 1986. Farafra flock was introduced to Mallawi Research Station in 1992; Farafra is a local sheep dominate in El-Farafra Oasis of the Egyptian western desert. The sheep flock was managed under an accelerated lambing system. Animals were fed according to recommendation of APRI (2000). Milk yield was characterized using 176 ewes. Ewes were selected after one week parturition throughout three lambing seasons. Milk yield was estimated by the lamb suckling weight differential technique (Economides, 1987). After the 8th week, lambs were weaned and milk yield was estimated by hand milking twice daily at 7 am and at 17 pm. Milk samples were taken every two weeks through lactation period from

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12 ewes during three seasons, for chemical analysis. Data were analysis statistically using the GLM procedure, LSM, (SAS, 1995), and Duncan's multiple range test (Duncan, 1955).

Results and Discussion

- **Milk yield**

1. Breed effect: Farafra ewes produced 0.675, 45.96, 13.43, 59.40 kg in 87.93 days, for DMY, MBW, MAW, TMY and LL, respectively. While, Chios ewes produced 0.703, 49.90, 16.77, 66.67 kg in 96.15 days, respectively. Breed differences were significant (P< 0.01& 0.5) with TMY, MBW, MAW and LL (Table, 1). The present figure of Chios was lower than that reported by Mousa (1991) who found TMY, MBW and LL were 143.2, 103.64 kg and 142 days, respectively. These results may be attributed to inbreeding in Chios flock and nutritional recommendation according to APRI (2000) were not suitable. Moreover, the better performance of Farafra ewes could be due to more adaptation for Egyptian subtropical conditions than exotic breed. Lactation curves were resulted from plotting average milk yield against lactation weeks for each breed are presented in Figure (1). It could be noticed that the Farafra and Chios ewes reached maximum yield at the second week of lactation [7.95 kg/week (1.13 kg/day) and 8.38 kg/week (1.19 kg/day)], after attaining the peak at the second week of lactation, milk yield decreased gradually till the end of lactation period.

2. Lambing season: Ewes lambed at the spring season (February – 69.50 kg) had greater milk yield compared to ewes lambed at the summer season (June –61.15 kg) and autumn season (October – 58.45 kg), seasonal differences had a highly significant effect (P< 0.01) on both milk yield and lactation length as shown in Table (1). Ewes lambed at spring season had a longer lactation length than those lambed at summer (June) season. The spring lambed ewes, showed more persistency in their week milk yield which resulted in higher total milk production than both summer or autumn lambed ewes. Milk yield of the spring season declined steadily after the peak of lactation (at the 2nd week of lactation), while summer or autumn season declined sharply after it peak (Figure, 2). Seasonal variation could be attributed mainly to nutritional and husbandry, i.e. availability of green fodder in addition of possible effect of the ambient environmental conditions. Ewes lambed during spring season (February) were fed green fodder during late pregnancy period and the whole lactation period. Also, Aboul-Naga et al., (1981) who found that milk yield during spring season (February) was significantly higher than those lambed during autumn (October) or Summer (May) seasons.

3. Type of birth: Ewes reared single lambs were produced 0.614, 41.53, 11.07, 52.60kg and 86.10 days, but ewes reared twin lambs were produced 0.764, 54.33, 19.13, 73.47kg and 97.98 days of DMY, MBW, MAW, TMY and LL, respectively (Table, 1). Average DMY, MBW and TMY increased with 24.4, 30.8 and 39.7% in ewes suckling twin lambs compared to those suckling single lambs, respectively. The differences due to number of suckling lambs were significant (P< 0.01) at each stage of lactation and lactation length (Table, 1). Ewes suckling twins produced more milk (P< 0.01) than those suckling single lambs at each stage of lactation. This phenomenon attributed to the ability of twin lambs to empty more completely the udder of their dams. Also, the more frequent suckling times applied to mammary glands by twins that single lambs. Milk yield of ewes rearing single or twins lambs increased with advancing of lactation period till it reached a peak at the second week then, it decreased gradually till the end of lactation period. Similar, results were reported by Aboul-Naga et al., (1981) who found that the differences due to number of suckling lambs were highly significant in Rahmani ewes. Also, Hassan (1995) indicated that ewes rearing twins produced much milk (74.8 kg) than those suckling single lambs (71.2 kg), during 138 days and 136 days, respectively.

4. Age of ewe: Ewes of (> 4 - ≤5) years old showed relatively higher milk yield than younger or older ones (Table, 1), total milk yield of the fourth group (> 4 - ≤5) years was the highest (66.55 kg) in spite of the shortest lactation period, they reach the maximum of lactation during this age. While, the first group (< 2) years gave the lowest amount 59.67 kg, but age of ewe at lambing differed not significantly with TMY, MAW and LL, while age of ewe was significant (P< 0.01) with average DMY and significant effect (P< 0.05) with MBW. Generally, average milk yield was increased with advancing increase age of ewe. As well as, Aboul Naga et al., (1981) and Hassan (1995), they noticed that age of ewe had not effect significant on milk yield.

5. Weight of ewe: Correlations coefficients between weight of ewes at lambing and each of average DMY, MBW, MAW and LL were a positive highly significant (P< 0.01). These results are in agreement with Al-Saigh and Al-Khauzai (1991) and (1993).

6. Lamb birth weight: A positive correlations and highly significant (P< 0.01) between birth weight of lambs and each of average DMY, MBW, MAW, TMY and LL. These results confirmed that the heavy lambs showed a good ability to stimulate their dams to produce more milk particularly during existed their early life. Also, Al-Saigh and Al-Khauzai (1993) found that the correlation coefficients and the linear regressions between lambs birth weights and their dams milk yield were highly significantly.

- **Milk composition**

1. Breed effect: Fat% averaged 6.17% for Chios and was significant (P< 0.01) higher than 5.59% for Farafra milk (Table, 2). Fat% increased gradually with advancing stage of lactation until the end of the lactation period. Chios had slightly higher average TS% than Farafra (16.04 *vs.* 15.59%), respectively. The SNF% averaged 10.01 and 9.87% for Farafra and Chios milk. Protein content for Chios and Farafra milk differed significant (P< 0.01) and averaged 5.62 and 5.31%, respectively. Ash in Farafra milk averaged 1.13% which was significantly (P< 0.01) higher than 0.97% for Chios milk. Chios ewes had higher milk energy (4.59 MJ/kg) than Farafra once milk energy (4.34 MJ/kg). The higher milk energy of Chios ewes was due to their higher fat percent than Farafra ewes. The differences between breeds were significant (P< 0.01). These results agreement with Economides (1986) reported that the calorific was 4.53 MJ/kg for Chios sheep's milk.

2. Lambing season: The autumn lambing ewes (October) had a higher fat%, TS%, SNF%, ash% and milk energy than both summer lambing (June) and spring season (February). Seasonal differences were significant (P< 0.01) for fat%, TS%, protein% and milk energy, but significant (P< 0.05) for ash% and were not significant for SNF% (Table, 2). These results may be attributed to the availability of fresh Egyptian clover and metabolic and endocrine changes related to the climate and the negative correlation between milk yield and fat%. Similarly, Sevi et al., (2004).

3. Lactation weeks: All parameters studied increased gradually throughout the 18 weeks of lactation. Whereas, fat% was 3.05% in the 2^{nd} week and it attained to 7.28% in the 18^{th} week, where the milk yield was decreased by advancing in the lactation period. Also, TS% was 13.24% in the 2^{nd} week and it attained to 17.37% in the 18^{th} week. They concluded that, fat%, protein%, TS% and ash decreased with advancing of lactation.

4. Age and weight of ewe: Regression coefficients of the milk components percentages on age and weight of ewe at lambing were not significant, except regression coefficients of protein% on age of ewe was positively significant (P< 0.01), and regression coefficients of ash% on weight of ewe was negatively significant (P< 0.01). Also, Hassan (1995) reported that age of ewe had not significant effect on fat, TS and SNF%.

There were a negative and significant (P< 0.01) correlations between milk yield with fat%, TS%, protein%, ash% and milk energy, but not significant with SNF%. Fat% positively significant (P< 0.01) correlation with TS%, protein% and milk energy. Similarly, Khalifa et al., (1994) found that significant correlation coefficient between milk fat and each of TS, SNF, protein and ash.

There were a positive and highly significant (P< 0.01) correlation between TS% and each of SNF%, protein% and milk energy, and negative highly significant (P< 0.01) correlation coefficient (r = -.161) between TS% and ash%. Also, positive and significant (P< 0.01) correlation coefficient was found between SNF% and ash%. As well as, positive and highly significant (P< 0.01) correlation coefficient (r= 0.683) was calculated between protein and milk energy.

Conclusion: The percentage of MBW (8 weeks) amounted 77.37% and 74.85% from the TMY for Farafra and Chios ewes, respectively. But, the percentage of MAW (marketable milk) amounted 22.63% and 25.15% from the TMY of Farafra and Chios ewes, respectively. These results indicated that most of the milk yield of local ewes (Farafra) were produced during suckling period (8 weeks). So, early weaning system was more suitable for Farafra ewes. From another point of view, the present figure for Farafra ewes are nearly of other Egyptian native breeds. Also, Chios flock must be improvement of milk yield by import good rams

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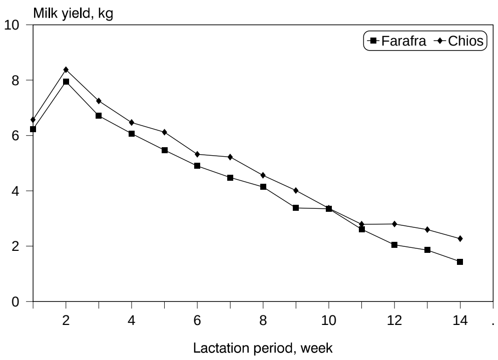

Fig. 1. Lactation curves of Farafar and Chios ewes

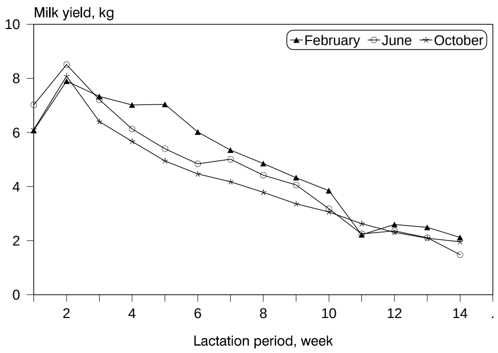

Fig. 2. Lactation curves of February, June and October season.

Table (1): LSM±SE of factors affecting milk yield (kg) at different stages and lactation length.

Items	N	DMY/g	MBW/kg	MAW/kg	TMY/kg	LL/day
G. mean	176	0.634±0.13	43.10±8.78	12.62±5.34	55.72±11.67	87.97±10.94
Breed effect			*	**	**	**
Farafra	136	0.675±0.01	45.96±0.88	13.43±0.54	59.40±1.18	87.93±1.10
Chios	40	0.703±0.02	49.90±1.66	16.77±1.01	66.67±2.21	96.15±2.07
Type of birth		**	**	**	**	**
Single	133	0.614±0.01	41.53±0.96	11.07±0.58	52.60±1.28	86.10±1.20
Twins	43	0.764±0.02	54.33±1.59	19.13±0.96	73.47±2.11	97.98±1.98
Lambing season		**	**	**	**	**
February	72	0.736±0.02 [a]	51.60±1.25 [a]	17.91±0.76[a]	69.50±1.66 [a]	95.29±1.56 [a]
June	45	0.721±0.03 [a]	48.54±1.99 [b]	12.62±1.21[b]	61.15±2.66 [b]	84.72±2.49 [b]
October	59	0.610±0.02 [b]	43.66±1.48 [b]	14.78±0.09[a]	58.45±1.97 [b]	96.10±1.85 [a]
Age of ewe		**	*			
<2	40	0.638±0.02[c]	44.83±1.71[c]	14.83±1.04[b]	59.67±2.27[ab]	93.06±2.13 [a]
>2 - ≤ 3	36	0.686±0.02[bc]	47.08±1.70[bc]	16.12±1.03[a]	63.20±2.26[b]	93.42±2.12 [a]
>3 - ≤4	21	0.721±0.03[b]	50.88±2.07[a]	13.58±1.27[b]	64.46±2.75[a]	98.95±2.58 [a]
>4 - ≤5	24	0.741±0.03[a]	50.79±2.02[b]	15.76±1.23[ab]	66.55±2.69[a]	90.55±2.52 [a]
>5	55	0.659±0.02[bc]	46.07±1.36[bc]	15.23±0.83[ab]	61.30±1.81[ab]	93.20±1.70 [a]

a - c: means in the same column within classification with different superscript for each factor differ ($p<0.05$). DMY= daily milk yield, MBW= total milk yield pre-weaning, MAW= total milk yield post-weaning, TMY= total milk yield, LL= lactation length.

Table (2): LSM±SE of factors affecting milk composition.

Items	N	Fat %	TS %	SNF %	Protein %	Ash %	Milk energy (MJ/kg)
G. mean	228	5.22±1.22	15.04±1.39	9.82±1.19	4.93±0.98	1.07±0.25	4.19±0.53
Breed effect		**	**		**	**	**
Farafra	113	5.59±0.17	15.59±0.19	10.01±0.17	5.31±0.14	1.13±0.03	4.34±0.07
Chios	115	6.17±0.16	16.04±0.18	9.87±0.15	5.62±0.12	0.97±0.03	4.59±0.07
Lambing season		**	**		**	*	**
February	82	4.92±0.17^{b}	14.81±0.19^{c}	9.89±0.16^{a}	4.16±0.13^{c}	1.11±0.03^{a}	4.06±0.07^{b}
June	70	5.65±0.20^{b}	15.68±0.22^{b}	10.03±0.19^{a}	6.47±0.16^{a}	1.01±0.04^{a}	4.37±0.08^{b}
October	76	7.07±0.18^{a}	16.96±0.21^{a}	9.90±0.18^{a}	5.79±0.15^{b}	1.04±0.04^{a}	4.98±0.08^{a}
Lactation weeks		**	**	**	**	*	**
W 2	36	3.05±0.20^{f}	13.24±0.23^{d}	10.19±0.20^{a}	4.12±0.16^{e}	1.20±0.04^{a}	3.25±0.09^{f}
W 4	36	3.53±0.20^{f}	13.01±0.23^{d}	9.48±0.20^{a}	3.94±0.16^{e}	1.08±0.04^{a}	3.46±0.09^{f}
W 6	36	4.74±0.20^{e}	14.17±0.23^{cd}	9.43±0.20^{a}	4.32±0.16^{de}	1.06±0.04^{a}	3.98±0.09^{e}
W 8	36	5.51±0.20^{de}	15.05±0.23^{bc}	9.54±0.20^{a}	4.93±0.16^{cde}	1.05±0.04^{a}	4.31±0.09^{de}
W10	36	6.27±0.20^{cd}	16.13±0.23^{b}	9.86±0.20^{a}	5.53±0.16^{abc}	1.03±0.04^{a}	4.64±0.09^{cd}
W12	31	7.62±0.22^{ab}	17.97±0.25^{a}	10.35±0.21^{a}	6.57±0.19^{a}	0.98±0.04^{a}	5.22±0.09^{ab}
W14	11	7.63±0.37^{abc}	17.75±0.42^{a}	10.12±0.36^{a}	6.73±0.30^{ab}	1.03±0.08^{a}	5.22±0.16^{abc}
W16	4	7.29±0.62^{a}	17.65±0.71^{a}	10.37±0.60^{a}	6.56±0.50^{ab}	1.06±0.13^{a}	5.07±0.27^{a}
W18	2	7.28±0.88^{bcd}	17.37±1.00^{b}	10.10±0.86^{a}	6.54±0.71^{bcd}	0.99±0.18^{a}	5.07±0.38^{bcd}

a – f : means in the same column within classification with different superscript for each factor differ ($p<0.05$).