

**COMPARATIVE STUDY BETWEEN SINAI AND RAHMANI SHEEP. 2- PERFORMANCE OF EWES DURING PREGNANCY AND LACTATION, BIRTH AND WEANING WEIGHTS OF LAMBS**

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**SUMMARY**

This study was conducted through two successive years starting from the first mating of ewes. In the first year 15 Sinai and 9 Rahmani ewes and in the second year 17 Sinai and 8 Rahmani ewes and their offsprings were included. Milk yield was determined (hand milking) once a week from the 2<sup>nd</sup> till the 17<sup>th</sup> week post-partum in the first and the second season of lactation. Three composite milk samples of 3 ewes of each breed were analysed for chemical composition.

Mean body weights of Sinai and Rahmani ewes were 25.0 and 35.8 Kg at mating and 27.1 and 41.5kg immediately post-partum, respectively. The increase in Sinai and Rahmani ewes live weight through the last two months was, respectively about 69% and 76% of the total increase achieved through the whole gestation period. The weight of Sinai lamb averaged  $2.9 \pm 0.10$  Kg at birth,  $13.8 \pm 0.65$  Kg at weaning (18 weeks of age) and  $16.4 \pm 0.87$  kg at 6 months of age. The corresponding values of Rahmani lambs were  $3.8 \pm 0.15$ ,  $16.8 \pm 0.82$  and  $22.5 \pm 0.97$  Kg, respectively.

Daily milk yield (DMY) of Rahmani ewes averaged 384.1g. and was significantly higher than that of Sinai ewes (291.8g). However, DMY/kg of metabolic body weight ( $BW^{0.75}$ ) was 24.9g for Sinai and 22.8g for Rahmani ewes. Significant correlation coefficient was found between weekly milk yield and weekly ewe body weight (0.544). Maximum DMY was achieved during the 2<sup>nd</sup> week of

lactation (518.4g), then gradually decreased till the 17<sup>th</sup> week of lactation (148.6 g). Milk yield was significantly higher in the second season (41.8kg) than in the first season of lactation (32.3 kg).

Rahmani milk contained significantly higher percentages of total solids (16.63), fat (5.58), solids not fat (11.04), protein (5.26), lactose (4.92) and ash (0.90) than Sinai milk. Corresponding values for Sinai milk were 14.67, 4.14, 10.53, 5.07, 4.62 and 0.82, respectively. The percentages of milk components were significantly higher in the second lactation season than in the first one in both breeds.

**Keywords:** Sheep, Rahmani, Sinai, Pregnancy, lactation, body weight

#### INTRODUCTION

The major sources of red meat and milk in Sinai communities are sheep, goats and camel. The available knowledge about productivity of Sinai sheep are scarce. This work aimed to study the performance of Sinai ewes during pregnancy and lactation and birth weight and growth of their lambs till 6 months of age compared to Rahmani ewes as reference for native strains.

#### MATERIALS AND METHODS

This work was carried out at the Animal production farm, Department of Animal Production, Faculty of Agriculture, Suez Canal University.

#### Animals and feeding

Over two years, 1991-1993, eighteen Sinai ewes, nine Rahmani ewes aged between 18 to 24 months and their offsprings produced over two lambing seasons for the two strains were included in this study. The ewes were lambed once a year, whereas September of each year was the season of mating. The lambs were weaned by the age of 4 months. The ewes were fed according to their body weights following the daily allowances given by Ghoneim (1967) for local sheep in terms of starch value units and digestible protein/head. In winter and spring, the animals were fed on a commercial concentrate diet and Egyptian clover (*Trifolium alexandrinum*) however in

summer and autumn, clover was replaced by clover hay. The concentrate diet contained 12.1% crude protein, 13.3% crude fibers, 6.8% crude fat, 47.8% NFE and 9.4% ash. Animals had free access to liberal amounts of rice straw. Water was always available in the yards. During the last 8 weeks of gestation daily feed allowances were increased by 40% and over the lactation period they were increased by 200% over the maintenance level of energy and protein.

#### **Body Weight**

Mature animals and their offsprings (from birth to 6 months) were weighed weekly. All animals were fasted overnight before weighing around 8.00 a.m. The body weights were recorded to the nearest 0.2kg.

#### **Milk Yield**

Milk yield was recorded once weekly over 16 week period starting from the last day of the 2<sup>nd</sup> week of parturition. Lambs were separated from their dams for 24 hours before milking. The ewes were hand-milked to ensure stripping of the udder. Amount of milk produced from each individual was recorded and sampled for chemical analysis.

#### **Milk Composition**

Six composite milk samples from six ewes (Three ewes from each strain) were chemically analysed to determine fat, protein, total solids, lactose and ash. Fat content according to Gerber method as described by Ling (1956). Total nitrogen was estimated by the Macro Kjeldahl method as described by Rowland (1938). Lactose content was measured calorimetrically according to Barrent and Abd El-Tawab (1957). Ash total solids contents were determined according to A.O.A.C. methods (1975).

#### **Statistical Analysis**

Statistical analysis was performed using the General Linear Models (GLM) Procedure of the SAS statistical package (SAS institute, 1987). Least square analysis of variance was used for body parameters, and milk yield and composition. Simple correlation coefficients were estimated for milk yield and components, ewe body weight and lamb weights.

## RESULTS AND DISCUSSION

### 1- Change in ewes live weight during pregnancy

Changes in average live weight of Rahmani and Sinai ewes during gestation over the two seasons are presented in Table 1. Average live weight of ewes increased gradually from mating time to the end of 3<sup>rd</sup> month of gestation, then increased sharply during the late gestation period (4<sup>th</sup> and 5<sup>th</sup> months of gestation over the two seasons). Such late increases represented about 69% of the total increase achieved through the whole gestation period in Sinai ewes and about 76% in Rahmani ewes. This finding agrees with Wallace et al (1948), Robinson (1957), Diggins and Bundy (1958) and Abd El-Karim (1981). On the other hand, as Table 1 shows the conceptus weight was 19.6% of the post-partum live weight of Sinai ewes and about 15% of Rahmani ewes. The average conceptus weight (Table 1) minus the average birth weight of lambs (Table 2) resulted in almost the same averages, 2.3 kg for Rahmani and 2.4kg for Sinai ewes considering that there were no changes in fetus weight 1-2 day before birth. Average changes in Rahmani live weights (from mating to post-partum weight) were 6.5 and 4.6kg for the 1<sup>st</sup> and 2<sup>nd</sup> seasons and 1.7 and 2.4kg for Sinai ewes in respective order. This increase in ewe body weights may reflect suitable feeding level used throughout pregnancy period.

### 2- Changes in lamb weight from birth to 6 months of age

Data presented in Table 2 exhibits body weight and gain changes over different stages from birth up to 6 months of age for Rahmani and Sinai lambs during the two lambing seasons. During the 1<sup>st</sup> season average body weight at birth (BW), at weaning (WW), and at 6 months of age (W6) in Rahmani lambs were 4.0, 15.0 and 21.6kg, respectively. The corresponding averages for Sinai lambs were 2.8, 13.6 and 15.5kg, respectively. Differences between the two breeds were not significant in WW. However BW and W6 differed significantly ( $P < 0.01$ ) in the two breeds. During the 2<sup>nd</sup> season the same trend was observed for average BW, WW and W6 in the two breeds. Whereas differences between breeds were not significant at birth, significant ( $P < 0.05$ ) at weaning and significant ( $P < 0.01$ ) at 6 months of age.

Table 1. Changes in live weight (Kg) of Rahmani and Sinai ewes during gestation period of the two seasons

Gestation period (months)	The 1 <sup>st</sup> season		The 2 <sup>nd</sup> season		Total	
	Rahmani	Siani	Rahmani	Sinai	Rahmani	Sinai
Ewes live weight						
At mating	34.9±1.3	24.3±1.2	36.9±2.0	25.6±1.7	35.9±1.7	25.0±1.4
1 <sup>st</sup> month	34.2±1.4	24.7±1.2	37.9±2.4	26.8±1.8	36.1±1.9	25.8±1.5
2 <sup>nd</sup> month	35.3±1.2	25.2±1.3	39.7±2.6	27.4±1.9	37.5±1.9	26.3±1.6
3 <sup>rd</sup> month	36.3±1.3	25.8±1.4	41.2±2.8	28.7±1.9	38.8±2.1	27.3±1.6
4 <sup>th</sup> month	42.7±1.6	27.1±1.6	44.2±3.2	31.1±1.9	43.5±2.4	29.1±1.7
5 <sup>th</sup> month (1-2 day post-partum)	48.0±1.9	31.2±1.4	47.1±3.2	33.5±2.2	47.6±2.5	32.4±1.8
Post-partum weight	41.4±1.7	26.0±1.3	41.5±3.1	28.2±2.1	41.5±2.4	27.1±1.7
Conceptus weight*	6.6	5.2	5.6	5.3	6.1	5.3
(%) of post-partum weight	(15.9)	(20.0)	(13.5)	(18.8)	(14.7)	(19.6)
**	6.5	1.7	4.6	2.4	5.6	2.1

\* Approximate weight of fetus, placenta and embryonic fluids.

\*\* The increase in body weight (kg) of the ewe from mating till parturition.

Pooling the results obtained over the two lambing seasons (Table 2) resulted in mean BW, WW and W6 of 3.8, 16.8 and 22.5kg for Rahmani lambs and 2.9, 13.8 and 16.4kg for Sinai lambs. Differences between breeds were significant ( $P < 0.01$ ) at different stages of age. Heavier ewes usually produce heavier lambs at birth. This could be concluded also from Table (3) whereas significant correlation coefficient was found between ewe body weight and birth weight of lamb (0.665). On the other hand Rahmani lambs suckled more milk of higher nutritional value as observed in tables 4 and 5 than Sinai lambs. Positive and highly significant ( $P < 0.01$ ) correlation coefficient (0.330) was found between weekly gain of lamb body weight and weekly milk yield (Table 3).

Pooling the results obtained over the two seasons revealed that mean daily gains from BW-WW and WW-W6 were 108.7 and 95.9 for Rahmani lambs, 90.8 and 43.7 g for Sinai lambs. In this respect, it is worthy to note that

Table 2. Average body weight (kg) and daily gain (g) in Rahmani and Sinai lambs as affected by breed and parity

Items	First season		Second season		Overall	
	Rahmani	Sinai	Rahmani	Sinai	Rahmani	Sinai
Number of lambs	9	15	8	17	17	2
Birth weight (BW)	4.0±0.17**	2.8±0.13	3.5±0.23*	3.0±0.14	3.8±0.15**	2.9±0.10
Weaning weight (WW)	15.0±0.79**	13.6±0.59	18.6±1.14**	14.0±1.16	16.8±0.82**	13.8±0.65
Weight at 6 months old (W6)	21.6±1.45	15.5±0.81	23.4±1.29	17.2±1.48	22.5±0.97	16.4±0.87
Daily gains (g)	91.7±6.30**	90.0±4.70	125.8±8.75*	91.6±9.16	108.7±6.82*	90.8±5.18
BW - WW	110.6±13.21	32.4±6.09	81.0±8.14	53.8±9.66	95.9±8.41	43.7±6.22

\* Significant at P &lt; 0.05 and \*\* Significant at P &lt; 0.01

Table 3. Simple correlation coefficient among some parameters

Parameters	Weekly milk yield (ml)		
	Rahmani	Sinai	Total
Weekly ewe body weight	0.592** (n = 120)	0.399** (n = 160)	0.544** (n = 280)
Post-partum ewe body weight	0.742** (n = 15)	0.490* (n = 20)	0.651** (n = 35)
Weekly gain of lamb body weight	0.235	0.354 (n = 160)	0.330 (n = 280)
Ewe body weight immediately post-partum	Birth weight of lamb		
	Rahmani	Sinai	Total
	0.164 (n = 16)	0.644** (n = 19)	0.665** (n = 35)

\* Significant at P &lt; 0.05 and \*\* Significant at P &lt; 0.01

while mean daily gains differ significantly ( $P < 0.05$ ) between the two breeds (109 vs 91 g) during the suckling period (BW-WW), there was a relatively sharp drop in average gains during the two months next to weaning for Sinai compared to Rahmani lambs (96 vs 44g). This difference was significant ( $P < 0.01$ ) in the first season and was confirmed when data were pooled over the two seasons ( $P < 0.01$ ). In the meantime this difference were reflected on average daily gains overall the period from birth up to 6 months of age being 104 in Rahmani vs 75g in Sinai lambs. Possible reasons for the post-weaning drop in average daily gain of Sinai lambs might need further investigation.

In this work average BW of Rahmani lambs (3.8kg) is quite close to values reported by Abbas (1978), Hassona (1980), Ashmawy (1981), Bata (1982) and Mabrouk *et al.* (1983). Weaning weight and weights at later ages are relatively lower than those reported by Swidan (1979), Ashmawy (1981), Aboul-Naga *et al.* (1982) and Aboul-Naga and Aboul-Ela (1987), possibly this may be due to feeding level, age and weight of dams and post-weaning feeding level applied to lambs.

### 3- Milk Yield

#### a- Effect of breed

The daily milk production from Rahmani and Sinai ewes throughout the period from the 2<sup>nd</sup> until the 17<sup>th</sup> week of lactation (Table 4) averaged  $384.1 \pm 13.2$  and  $291.7 \pm 8.1$ g, respectively. However, metabolic unit of Sinai ewe body produced more milk, about 25g milk/day compared to about 23g, milk/day only for unit of Rahmani metabolic body weight (Table 4). The preceding averages of daily milk yield are quite lower than those reported in other studies conducted in Egypt. El-Gindi, *et al.* (1972) reported 420g average daily milk yield in Rahmani ewes (hand milking) in the first 14.4 weeks of lactation. Although, Rahmani was significantly ( $P < 0.01$ ) superior in milk production to Sinai, it is not considered a high lactation breed. Significant differences between Awassi, Barki and Merino in milk yield were reported by El-Shahat (1970), and also between Barki, Ossimi and Rahmani sheep (Farag, 1979) and between Awassi, Chios and Ossimi sheep (Mousa *et al.*, 1993).

Table 4. Means±SE for daily milk yield (g) of Rahmani and Sinai ewes as affected by parity and lactation period

Weeks of lactation*	Milk Yield					
	First Lactation		Second Lactation		Overall	
	Rahmani	Sinai	Rahmani	Sinai	Rahmani	Sinai
2	472.3±96	459.0±14	624.6±28	500.5±16	540.7±57.3	497.0±28.0
3	461.0±12	427.4±13	592.8±27	421.3±15	519.0±56.1	416.5±29.1
4	441.7±99	399.8±12	564.1±29	384.6±17	495.3±38.2	383.5±31.9
5	446.8±76	362.0±11	556.9±29	372.3±18	424.0±36.4	365.5±32.5
6	420.2±66	328.5±13	552.8±29	355.9±15	479.7±36.1	339.3±20.7
7	381.5±93	366.5±9	546.7±23	332.3±13	438.7±36.1	340.8±20.5
8	387.6±41	286.5±19	532.3±23	323.1±12	454.0±45.7	298.0±23.2
9	369.2±95	266.4±12	501.4±18	321.0±11	429.7±39.9	287.0±27.6
10	299.9±10	197.9±85	462.5±10	314.9±62	371.7±39.3	261.8±24.5
11	266.2±44	205.0±96	448.5±19	314.9±62	355.0±36.3	244.3±22.7
12	240.7±58	185.6±87	413.5±11	303.6±53	325.0±36.3	229.8±21.5
13	188.2±69	202.0±82	341.3±11	282.1±76	263.7±30.7	219.0±22.1
14	164.2±35	163.2±68	320.0±91	277.0±90	241.7±26.7	201.8±22.5
15	161.8±35	212.2±97	244.1±92	236.9±85	218.3±25.6	204.3±21.9
16	133.6±32	152.0±76	256.4±89	203.1±64	198.7±23.3	165.3±18.1
17	109.1±38	117.3±61	227.7±10	148.7±45	168.3±25.2	127.3±14.0
Overall	307.8±13.5	272.3±11.4	449.0±20.2	309.5±11.4	384.1±13.2	291.7±8.12
DMY/MBW	18.50±0.79	24.59±2.38	26.65±2.52	25.16±1.99	22.82	24.87

\* Milk yield was determined on the last day of each week.  
 DMY/MBW Daily milk yield per unit of metabolic body weight (body weight<sup>0.75</sup>)



b- Effect of stage of lactation

Milk production gradually decreased from the 2<sup>nd</sup> week till the end of the 17<sup>th</sup> week of lactation in both breeds during two successive seasons of lactation as shown in Table 4. In other words the peak of milk production was attained at the second week of lactation after which milk production gradually decreased. Ewes that are low milk producers tend to have an early peak compared with ewes with high milk production (Bonsma, 1939). The fluctuations of milk yield through the weeks of lactation in present study is in agreement with that reported by Peart (1967, 1968 and 1970) on Blackface ewes and Farag (1979) on Rahmani, Ossimi and Barki ewes.

c- Effect of season of lactation

Daily milk yield of Rahmani and Sinai ewes averaged  $449.0 \pm 20.2$  and  $309.5 \pm 11.4$ g, respectively in the second season and  $307.8 \pm 13.5$  and  $272.3 \pm 11.4$ g, respectively in the first season of lactation (Table 4). About 30% increase in daily milk yield was obtained in the second season of lactation as compared to the 1<sup>st</sup> season. In dairy cattle there is a tendency for the amount of milk produced to increase with successive lactations up to the 4<sup>th</sup> lactation and declines thereafter. The effect of season of lactation on milk yield in sheep showed a similar pattern. Most studies reported the 4<sup>th</sup> -5<sup>th</sup> season of lactation as the highest milk production seasons in sheep (Montanaro, 1940 on Sicilian sheep; Donev, 1965 on Fine and semifine wool ewes; Barghout, 1975 on Barki ewes; Farag, 1979 on Rahmani, Ossimi and Barki ewes and Hossamo *et al.*, 1985 on Awassi ewes). In Rahmani ewes the increase in average daily milk was about 46% in the second lactation season while it was about 14% only in Sinai ewes (Table 4). Body weight of Rahmani ewes averaged  $41.7 \pm 4.9$  and  $44.13 \pm 7.3$  kg, immediately after the first and the second parturitions. However the corresponding values for Sinai ewes averaged  $24.8 \pm 4.6$  and  $27.8 \pm 4.9$  kg, respectively. In dairy cattle (Larson, 1985) reported that an increase of 30% in milk yield occurs throughout four successive lactation seasons due to growth in body and udder. This observation may explain also the significant ( $P < 0.01$ ) interaction between breed and lactation season in daily milk yield (Table 8). In the present work, highly significant ( $P < 0.01$ ) correlation coefficient (0.544) was

found between weekly ewe body weight and weekly milk yield as shown in Table 3. Also, post-partum ewe body weight was significantly ( $P < 0.01$ ) correlated (0.651) with milk yield throughout the studied 16 weeks of lactation (Table 3). These correlation coefficients are in agreement with those reported by Burris and Baugus (1955) on Hampshire, Owen (1957) on Hill sheep and Jancic (1971) on Pramenka sheep and their Merino crossbreds.

#### 4- Milk composition

The mean total solids (TS), fat (F), solids not fat (SNF), protein (P), lactose (L) and ash of Rahmani (R) and Sinai (S) milk are presented in Tables 5 and 6.

##### a- Effect of breed

The average TS in Rahmani milk was  $16.63 \pm 0.16\%$  being significantly ( $P < 0.01$ ) higher than  $14.67 \pm 0.12\%$  in Sinai milk (Tables 5 and 8). On Rahmani milk composition El-Gindi *et al.* (1972) reported 19.08% TS, while, Farag (1979) reported 17.23% TS. Mousa *et al.* (1993) on Awassi, Chios and Ossimi sheep stated breed differences in their milk contents of TS. Fat content for Rahmani and Sinai milk averaged  $5.58 \pm 0.10$  and  $4.14 \pm 0.07\%$ , respectively. Milk fat percentage of ewes largely varied in the available literature. In Rahmani milk, El-Gindi *et al.* (1972) reported 7.54%, while Farag (1979) reported 6.96%. These differences may be due to the experimental circumstances of each study. Milk fat content of the present study was closer to that (5.26%) reported by Latif (1989) on Rahmani breed. Highly significant ( $P < 0.01$ ) differences were detected between the two breeds in milk fat content as presented in Table 8. Latif *et al.* (1989) on Rahmani, Barki and their crosses found significant breed differences in milk fat contents. The SNF averaged  $11.04 \pm 0.08\%$  for Rahmani and was significantly ( $P < 0.01$ ) higher than  $10.53 \pm 0.08\%$  for Sinai milk. On Rahmani milk composition El-Gindi *et al.* (1972) reported 11.54% SNF while Latif *et al.* (1989) reported 11.06% only. Mousa *et al.* (1993) reported significant differences in milk fat and SNF of Awassi, chios and Ossimi sheep.

Protein content for Rahmani and Sinai milk was significantly different ( $P < 0.01$ ) and averaged  $5.26 \pm 0.05$  and  $5.07 \pm 0.05\%$  respectively. Milk protein of Rahmani was

Table 5. Mean±SE of milk composition percentages of Rahmani and Sinai ewes during the two lactation seasons

Lactations	Milk composition%	Rahmani	Sinai	Overall
First	Total Solids	16.05±0.19	14.24±0.12	15.15±0.15
	Fat	5.18±0.01	3.99±0.06	4.58±0.08
	Solids not fat	10.88±0.12	10.26±0.11	10.57±0.09
	Protein	5.14±0.08	4.99±0.09	5.07±0.06
	Lactose	4.85±0.03	4.45±0.04	4.65±0.03
	Ash	0.89±0.03	0.81±0.01	0.85±0.01
Second	Total Solids	17.20±0.23	15.10±0.18	16.15±0.18
	Fat	5.96±0.17	4.29±0.12	5.14±0.14
	Solids not fat	11.21±0.09	10.81±0.11	11.01±0.07
	Protein	5.37±0.07	5.15±0.06	5.26±0.05
	Lactose	4.99±0.02	4.79±0.04	4.89±0.03
	Ash	0.91±0.01	0.84±0.01	0.87±0.01
Overall	Total Solids	6.63±0.16	14.67±0.12	15.65±0.12
	Fat	5.58±0.10	4.14±0.07	4.86±0.08
	Solids not fat	11.04±0.08	10.53±0.08	10.79±0.06
	Protein	5.26±0.05	5.07±0.05	5.16±0.04
	Lactose	4.93±0.02	4.62±0.03	4.77±0.02
	Ash	0.90±0.01	0.82±0.01	0.86±0.01

Table 6. Mean total solids (TS), fat (F), solids not fat (SNF), protein (P), lactose (L) and ash of Rahmani (R) and Sinai (S) milk

Weeks of lactation*	Milk constituents %																							
	TS				F				SNF				P				L				Ash			
	R	S	Av.	S.E.	R	S	Av.	S.E.	R	S	Av.	S.E.	R	S	Av.	S.E.	R	S	Av.	S.E.	R	S	Av.	S.E.
2	16.13	13.03	13.58	4.42	3.99	4.19	9.72	9.06	9.39	4.50	4.27	4.38	4.53	4.19	4.36	0.79	0.71	0.75	4.58	4.58	0.81	0.81	0.79	0.75
3	15.73	13.73	14.18	5.72	3.82	4.43	10.14	9.47	9.74	4.52	4.35	4.43	4.75	4.43	4.58	0.81	0.73	0.76	4.65	4.65	0.82	0.82	0.81	0.77
5	15.47	12.93	14.73	3.09	3.84	4.38	10.35	9.99	10.02	4.65	4.48	4.57	4.79	4.61	4.65	0.84	0.76	0.80	4.73	4.73	0.84	0.84	0.81	0.80
7	15.27	14.52	14.75	5.90	3.89	4.32	10.81	10.24	10.52	4.91	4.64	4.80	4.84	4.68	4.76	0.85	0.81	0.82	4.76	4.76	0.82	0.82	0.81	0.82
8	15.29	14.52	14.75	2.10	4.24	4.65	10.70	10.32	10.50	5.06	4.82	4.94	4.89	4.72	4.80	0.85	0.81	0.82	4.76	4.76	0.82	0.82	0.81	0.82
9	15.29	14.52	14.75	2.90	3.84	4.49	11.00	10.72	10.85	5.09	4.94	5.01	4.89	4.68	4.83	0.87	0.79	0.83	4.83	4.83	0.87	0.87	0.81	0.83
10	15.29	14.52	14.75	2.50	3.72	4.47	11.26	10.72	10.92	5.17	5.07	5.08	5.06	4.62	4.84	0.89	0.83	0.85	4.84	4.84	0.89	0.89	0.81	0.85
11	15.29	14.52	14.75	2.09	4.02	4.66	11.03	10.72	10.92	5.26	5.07	5.16	5.06	4.44	4.71	0.89	0.81	0.85	4.84	4.84	0.89	0.89	0.81	0.85
12	17.30	14.78	16.34	0.29	4.06	4.90	11.14	10.61	10.87	5.38	5.20	5.29	5.19	4.58	4.77	0.93	0.84	0.88	4.85	4.85	0.94	0.94	0.81	0.88
13	17.30	14.78	16.34	0.29	4.06	4.90	11.14	10.61	10.87	5.38	5.20	5.29	5.19	4.58	4.77	0.93	0.84	0.88	4.85	4.85	0.94	0.94	0.81	0.88
14	18.03	15.72	16.62	0.20	4.30	5.10	11.82	11.11	11.37	5.66	5.52	5.59	5.55	4.70	4.88	0.97	0.86	0.91	4.88	4.88	0.97	0.97	0.86	0.91
15	18.03	15.93	17.07	0.57	4.30	5.10	11.82	11.11	11.37	5.66	5.52	5.59	5.55	4.70	4.88	0.97	0.86	0.91	4.88	4.88	0.97	0.97	0.86	0.91
16	18.03	16.48	17.46	0.57	4.35	5.23	12.13	11.53	11.83	5.71	5.62	5.66	5.63	4.74	4.88	0.99	0.90	0.94	4.88	4.88	0.99	0.99	0.90	0.94
17	18.03	16.61	17.72	0.57	4.35	5.23	12.13	11.53	11.83	5.71	5.62	5.66	5.63	4.74	4.88	0.99	0.90	0.94	4.88	4.88	0.99	0.99	0.90	0.94
Overall	16.63	14.67	15.65	5.58	4.14	4.86	11.04	10.53	10.79	5.26	5.07	5.16	4.92	4.62	4.77	0.90	0.82	0.86	4.77	4.77	0.90	0.90	0.82	0.86

\* Milk yield was determined at the last day of each week

lower 6.28% than reported by El-Gindi *et al.* (1972) and higher 4.94% than reported by Latif *et al.* (1989) in the same breed. Mousa *et al.* (1993) reported significant differences between Awassi, chios and Ossimi in milk protein contents.

Lactose in Rahmani milk averaged  $4.92 \pm 0.02\%$  which was significantly ( $P < 0.01$ ) higher than  $4.62 \pm 0.03\%$  for Sinai milk as shown in Tables (5 & 8). In Rahmani milk, El-Gindi *et al.* (1972) reported 4.29% lactose which was near to that found in the present study.

Ash content in Rahmani and Sinai milk averaged  $0.90 \pm 0.01$  and  $0.82 \pm 0.01\%$ , respectively. Milk ash percentage of Rahmani in the present study was slightly lower than 0.97% reported by El-Gindi *et al.* (1972).

#### b- Effect of season of lactation

The milk of the second season of lactation contained 1.0% TS, 0.56% fat and 0.2% protein more than milk of the first lactation (Table 5). The TS averaged 15.15 and 16.15 in first and second lactation seasons, respectively. The differences between the two lactation seasons in TS, fat and protein of milk were statistically significant ( $P < 0.01$ ) as shown in Table 8. The composition of ewe milk might differ with advancing age or parity of the ewe.

The trend of the present results is in agreement with other reports, where Ricardeau and Elamaut (1969) concluded that fat and protein content of ewe milk were higher in the second than in the first lactation. This is contrary to the situation for most dairy cattle breeds. Darwish (1985) mentioned that the percentage of fats and protein of sheep milk increased in the second season of lactation over the first one. Also, the lactose, ash and SNF percentages of the second lactation season was significantly ( $P < 0.01$ ) higher than those of the first one (Tables 5 and 8). Latif *et al.* (1989) on Rahmani and Barki milk composition, reported 16.35 and 16.76% TS, 5.28 and 5.64% fat, 4.86 and 5.53% protein for ewes aged 2-3 and 3-4 years, respectively. Denti and Vacca (1981) reported that SNF ranged from 11.1 to 13.9% throughout the first, second and third lactation season and an increase of SNF with advancing parity.

#### c- Effect of stage of lactation

The TS gradually increased ( $P < 0.01$ ) throughout the 16

weeks of lactation (Tables 6 and 8). Whereas the TS was 13.58% in the 2<sup>nd</sup> week it attained 17.72% in the 17<sup>th</sup> weeks as the milk yield was decreasing by advancement in the lactation period. The analysis of variance (Table 8) showed significant ( $P<0.01$ ) variation in TS due to the interaction between breed and weeks of lactation. The correlation coefficient was  $-0.456$  ( $P<0.01$ ) between milk yield and percentage of TS as shown in table 7. This conclusion is fairly consistent with that reported by El-Gindi, *et al.*, (1972); Eliya, *et al.* (1972); Peart, *et al.* (1975) and Mousa, *et al.* (1993). The relationship between TS and each of other milk constituents was positive and highly significant (Table 7).

Table 7. The simple correlation coefficients for milk characteristics of ewes (N=192)

Character	Total Solids	Fat	Solids not Fat	Protein	Lactose	ASH
Milk yield	-0.456**	-0.326**	-0.491**	-0.573**	-0.177*	-0.528**
Total solids		0.906**	0.814**	0.763**	0.738**	0.780**
Fat			0.491**	0.492**	0.591**	0.597**
Solids not fat				0.894**	0.707**	0.785**
Protein					0.472**	0.788**
Lactose						0.503**

\* Significant at  $P<0.05$  and \*\* Significant at  $P<0.01$

Milk fat of the second week of lactation was 4.19% on average for both breeds. However it increased significantly ( $P<0.01$ ) to reach 6.01% in milk of the 17<sup>th</sup> week of lactation (Tables 6 and 8). Throughout the studied period of lactation, there were slight fluctuations in milk fat content. The fluctuation in milk fat content with advancement in the stage of lactation was reported in sheep milk (Ashton *et al.*, 1964; Torres-Hernandez and Hohenkohen, 1980 and Latif *et al.*, 1989). Statistical analysis showed highly significant ( $P<0.01$ ) effect of interaction between

Table 8. Analysis of variance for milk yield and compositions of ewes as affected by breed, successive lactation seasons and weeks of lactation

Source of Variations	Milk composition									
	Mean Square Values					Daily milk yield				
	TS	F	SNF	P	L	Ash	df	Mean square	df	Mean square
Breed (B)	183.67**	100.49**	12.45**	1.73**	4.18**	0.27**	1	1007006.437**	1	1007006.437**
Lactation seasons (L)	47.89**	14.80**	9.45**	1.82**	2.70**	0.03**	1	1046153.002**	1	1046153.002**
Weeks of Lactation (W)	16.84**	3.33**	6.09**	3.11**	0.25*	0.08**	15	414270.415**	15	414270.415**
B x L	1.002	3.18**	0.61*	0.06	0.49**	0.00001	1	354680.578**	1	354680.578**
B x W	1.15**	1.12**	0.12	0.02	0.06*	0.003	15	17664.519	15	17664.519
L x W	0.466	0.99**	0.174*	0.101**	0.054*	0.01**	15	6875.964	15	6875.964
Error	0.257	0.31	0.08	0.020	0.03	0.002	511	17723.336	511	17723.336

breed, stage and season of lactation on milk fat content (Table 8). As previously mentioned, as milk yield increased the percentage of total solids decreased. Negative and significant ( $P < 0.01$ ) correlation coefficient ( $-0.326$ ) was found between milk fat percentage and milk yield (Table 7). Significant correlation coefficient was found between milk fat and each of TS ( $0.906$ ), SNF ( $0.491$ ), Protein ( $0.492$ ), lactose ( $0.591$ ) and ash ( $0.597$ ) as presented in Table 7.

SNF was raised from  $9.39\%$  in the 2<sup>nd</sup> week milk to  $11.73\%$  in the 16<sup>th</sup> and decreased slightly to reach  $11.64$  in the 17<sup>th</sup> week (Table 6). Stage of lactation significantly ( $P < 0.01$ ) affected SNF content in ewe milk (Table 8). El-Gindi, *et al.* (1972); Eliya, *et al.* (1972); Peart, *et al.* (1975) and Mousa, *et al.* (1993) reported that the stage of lactation significantly affected ewe milk composition. Significant interaction between season of lactation and each of breed ( $P < 0.05$ ) and week of lactation ( $P < 0.01$ ) was found to affect milk composition as shown in Table 8. The correlation coefficient between milk yield and SNF was significant ( $P < 0.01$ ) and negative ( $-0.491$ ) as shown in Table 7. Also, Table (7) showed positive and highly significant ( $P < 0.01$ ) relationship between SNF and each of the other milk constituents.

Milk protein of the second week of lactation was  $4.38\%$  gradually increased ( $P < 0.01$ ) to reach  $5.86\%$  in the 15<sup>th</sup> week and decreased again to reach  $5.78\%$  in the 17<sup>th</sup> week of lactation as shown in Table 6. the trend of protein content is quite parallel to that of SNF (Table 6). Negative and significant ( $P < 0.01$ ) correlation coefficient ( $-0.573$ ) was calculated between milk yield and percentage of milk protein (Table 8). However, positive and significant ( $P < 0.01$ ) correlation coefficients was calculated between percentage of milk protein and each of TS, fat, SNF, lactose and ash.

Lactose percentage was gradually increased ( $P < 0.05$ ) with the advancement in weeks of lactation (Tables 6 and 8). Whereas the lactose content was  $4.36\%$  in the milk of second week, it became  $4.94\%$  in the milk of 17<sup>th</sup> week. There was slight fluctuations throughout this period. The trend of lactose in the present results are fully consistent with. that of El-Gindi, *et al.* (1972); Peart, *et al.* (1975) and Mousa, *et al.* (1993). There were significant ( $P < 0.05$ ) differences due to the interaction



between weeks of lactation and each of breed and season of lactation. The correlation coefficient between milk yield and lactose content was  $-0.177$  and significant ( $P < 0.05$ ) as shown in table 7 the relationship between lactose percentage and the other milk constituents was positive and highly significant ( $P < 0.01$ ) as shown in Table 7.

Ash content of the second week milk averaged  $0.74\%$ . It increased to reach  $1.00\%$  in milk of the 16<sup>th</sup> week of lactation and slightly decreased to reach  $0.99\%$  in milk of the 17<sup>th</sup> week of lactation. Stage of lactation affected significantly ( $P < 0.01$ ) ash content (Table 8). El-Gindi, et al. (1972); peart, et al. (1975) and Abou Dawood, et al. (1980) reported that the stage of lactation affected ash content of ewe milk. Changes in ash percentage throughout weeks of lactation were not similar in the two seasons of lactation. Negative and significant ( $P < 0.01$ ) correlation coefficient ( $-0.528$ ) was calculated between milk yield and ash percentage. The correlation coefficient between ash percentage and each of the other milk constituents was significantly ( $P < 0.01$ ) positive as shown in Table 7.

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دراسة مقارنة بين الاغنام السيناوى والرحماني ٢- اداء النعاج اثناء الحمل وادرار اللبن واوزان الميلاذ والقطام للحملان

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نفذت هذه الدراسة خلال سنتين متتاليتين بداية من اول تلقيح للنعاج • استخدم فى السنة الاولى ١٥ نعجة سيناوى و ٩ نعاج رحمانى وفى السنة الثانية ١٧ نعجة سيناوى و ٨ نعاج رحمانى والنتاج الناتج • قدر محصول اللبن (حليب يدوى) مرة اسبوعيا من الاسبوع الثانى حتى الاسبوع ١٧ بعد الولادة فى موسمى الحليب • تم التحليل الكيماوى لثلاث عينات لبن ممثلة من ثلاث نعاج من كل سلالة •

كان متوسط اوزان النعاج السيناوى والرحماني على الترتيب ٢٥٠ و ٣٥٠,٨ كجم عند التلقيح و ٢٧,١ و ٤١,٥ كجم بعد الولادة مباشرة • وبلغت الزيادة فى وزن النعاج السيناوى فى الشهرين الاخيرين من الحمل حوالى ٦٩% من الزيادة الكلية فى وزن الجسم خلال فترة الحمل كلها بينما كانت الزيادة حوالى ٧٦% فى نعاج الرحمانى وكان متوسط وزن الحمل السيناوى ١٨±٢,٩ كجم عند الميلاذ و ١٣,٨±٠,٦٥ كجم عند القطام (عمر ١٨ اسبوع) و ١٦,٤±٠,٨٧ كجم عند عمر ٦ شهور • بينما المتوسطات المقابلة لوزن الحمل الرحمانى كانت على الترتيب ٣,٨±٠,١٥, ١٦,٠٨±٠,٨٢ و ٢٢,٥±٠,٩٧ كجم •

بلغ متوسط محصول اللبن اليومى للنعاج الرحمانى ٣٨٤,١ جم اعلى معنويا عنه للنعاج السيناوى (٢٩١,٨جم) • فى حين كان متوسط محصول اللبن اليومى لكل كجم وزن جسم تمثيلى (وزن الجسم ٠,٧٥\*) ٢٤,٩ جم للنعاج السيناوى و ٢٢,٨ جم للنعاج الرحمانى • ووجد معامل ارتباط معنوى بين محصول اللبن الاسبوعى ووزن النعجة (٠,٥٤٤). كان أقصى إنتاج لمحصول اللبن خلال الاسبوع الثانى من الادرار (١٨,٤جم) ثم نقص تدريجيا حتى الاسبوع السابع عشر من الادرار (١٤٨,٦جم) وكان محصول اللبن اعلى معنويا فى الموسم الثانى (٤١,٨كجم) عنه فى الموسم الاول (٣٢,٣كجم) •

إحتوى لبن الرحمانى على نسب مئوية أعلى معنويا من كل من المواد الصلبة الكلية ١٦,٦٣ والدهن ٥,٥٨، المواد الصلبة الغير دهنية ١١,٠٤٤ والبروتين ٥,٢٦ وسكر اللاكتوز ٤,٩٢ والرماد ٠,٩ عنه فى لبن السيناوى • وكانت القيم المقابلة فى لبن السيناوى هى على الترتيب ١٤,٦٧، ٤,١٤، ١٠,٥٣، ٥,٠٧، ٤,٦٢، ٠,٨٢ • وكانت النسب المئوية لمكونات اللبن اعلى معنويا فى موسم الحليب الثانى عنه فى الأول فى كلا النوعين •