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Effect of Vitamin "A" Supplementation on Ewes Productivity under Desert Condition

A.O. Sooud ; A.A. Younis ; M.A. El-Ashry*
and O. Shehata*
Department of Animal Production, Desert Institute, Mataria, Cairo, Egypt.

The effect of vitamin A supplementation on the fertility of ewes raised under desert condition was studied using 103 ewes of mixed ages (Awassi and Crosses with Barki). Experimental animals were randomized into three treatment groups i.e. control (no supplementation), medium (supplemented with 50,000 i.u. vit. A per head monthly and high (supplemented with 100,000 i.u. vit. A per head monthly). Supplementation with vitamin A started 3 months prior to mating and lasted up to weaning. All experimental groups received the same vitamin A deficient ration i.e. concentrates and straw.

Livebody weight of the control group was constant up to a variable time before death (2-5 days) at which it declined rapidly as a result of loss in appetite with an obvious drop in blood plasma vitamin A level. Night blindness was observed in the control group after 126-136 days, whereas xerophthalmia and nervous incoordination occured after 143-153 days and the first mortality case happened after 161 days from the start of the experiment. Novitamin A deficiency symptoms were observed in the two treated groups. There was no significant difference among different groups in the number of ewes marked by rams, however, conception rate differed significantly ($P < 0.01$) among different groups. The high level treated ewes produced significantly ($P < 0.05$) more viable lambs compared to the medium treated ones. Mortality rates were found to be 42.8, 8.8 and 2.9% for the control, medium and high treated ewes respectively. whereas it were 40 and 26.9% for lambs born to the medium and high treatment ewes respectively. Vitamin A supplementation at two different levels medium and high) for ewes was of no effect on the birth and weaning weights of the newborn lambs.

In the western coastal zone of Egypt the natural grazing season for sheep is limited as it only extends from late December to early April depending on the amount of rainfall which varies greatly from one year to another. It is not uncommon that in some years there is practically no grazing season. Thus during most part of the year, sheep are fed on dry vigetations and concentrates plus hay and straw. Under such conditions sheep usually suffer from vitamin A deficiency. Field observations on a flock of sheep kept at Ras El-hekma Experimental Station which belongs to the Desert Institute indicated symptoms of vitamin A deficiency in both ewes and lambs. A prelimenary study on the same flock by Ghanem (1967) showed improved

* Department of Animal Production, Fac. of Agric. Shobra El-Khiema ,Cairo, Egypt.

ferility by vitamin A supplementation to ewes during the breeding and pregnancy periods. Therefore, this study was carried out to investigate the effect of vitamin A supplementation on ewes during breeding, pregnancy and lactation.

Material and Methods

Experimental Animals

One hundred and three Awassi ewes and their crosses with Barki of mixed ages were used in the present work. Experimental animals were part of a flock of sheep raised at Ras El-Hekma Desert Research Station which is located in the western coastal zone of Egypt. Ewes were randomized to their treatment groups according to age, bread and live weight. All animals were free of vitamin A deficiency symptoms at the start of the experiment.

Management

At the *3rd* month before mating, all experimental animals were fed on vitamin A-deficient ration (wheat straw and a concentrated mixture) according to Morrison feeding standards (Morrison, 1955). The concentrated mixture consisted of 65% cottonseed meal, 20%, rice bran, 90% wheat bran, 3% molases, 2% limestone and 1% common salt. Three pure fertile Barki Rams were used for mating. Rams were allocated at random to the treatment groups and lasted for 51 day mating period. Oestrus was recorded daily as defined by marking with the ram.

Treatments

The present study included three treatment groups, i.e. control (not supplemented with vitamin -A), medium (supplemented with 50,000 IU. vitamin A/head/month in one dose) and high (supplemented with 100,000 IU. vitamin A/head/month in one dose). Rams were supplemented with 100,000 IU. vitamin A/head/month in one dose. Vitamin A administration was orally and took place at 3 months prior to mating and at monthly intervals therefater up to weaning. Vitamin A was supplemented as tablets (A-Viton), each contains 50,000 i. u. The number of ewes in each treatment group corresponded to 35, 34 and 34 ewes for the control, medium and high treatment groups respectively.

Blood Sampling for vitamin A determination

Six ewes were chosen at random from each treatment group for blood sampling at monthly intervals over the experimental period. Sampling was carried out from the jugular vein after 15 days of vitamin A-administration to avoid any temporary fluctuations in vitamin A blood plasma level.

The antimony trichloride method for the determination of Vitamin A in blood plasma described by Kimble, (1939) and modified by Glick (1957) was used in this trial.

Recording

Ewes were weighed before the start of the trial and at biweekly intervals throughout the experimental period. Lambs were weighed at birth and then at weekly intervals up to weaning.

Mortality was reocrded for both ewes and lambs. Genitalis of ewes died during the pregnancy period were examined for pregnancy. Thus, a full knowledge about concenption was obtained. Animals were always observed for vitamin A deficiency symptoms, i.e. , anorexia, nervous incoordination and xerophthalmia.

Statistical Procedure

Standard methods were used in analysing the results (Steel and Toori, 1960 and Snedecor, 1956), such as analysis of variance and Chi-square tests.

Results and Discussion

Live weight Changes in Ewes

Results given in Table 1 show the average live weight of ewes of the different treatment groups at certain points over the experimental period. Fig. 1 illustrates the live weight changes at monthly intervals. Due to the randomization of ewes according to their weight breed and age at the start of the trial, ewes of the different treatments did not differ significantly in their average initial weight. There was no statistical difference among the different treatment groups in live weight at mating. However, ewes of differrent reatments differed significantly ($P < 0.01$) in their weights at one month before the average lambing date. Ewes of the control group lost 0.65 kg over this period (from mating until before lambing). However, those of the medium and high groups gained 5.52 and 6.85 kg, respectively. The almost constant live weight for the control group was probably a result of being non-pregnant.

TABLE 1. **Average body weight of ewes (kg) at certain points over the experimental period**

Date	Control	Medium	High
Initial weight	39.2	38.4	38.5
8-4-1968).	(35)	(34)	(34)
Weight at mating	42.8	41.6	42.2
(8-7-1968)	(35)	(34)	(34)
Weight before lambing	42.2	47.1	49.0
(23-11-1968)	(29)	(34)	(34)
Weight after lambing	40.6	41.0	39.8
(23-1-1969)	(25)	(32)	(33)
Weight at weaning	41.0	41.9	38.9
(8-5-1969)	(20)	(31)	(33)

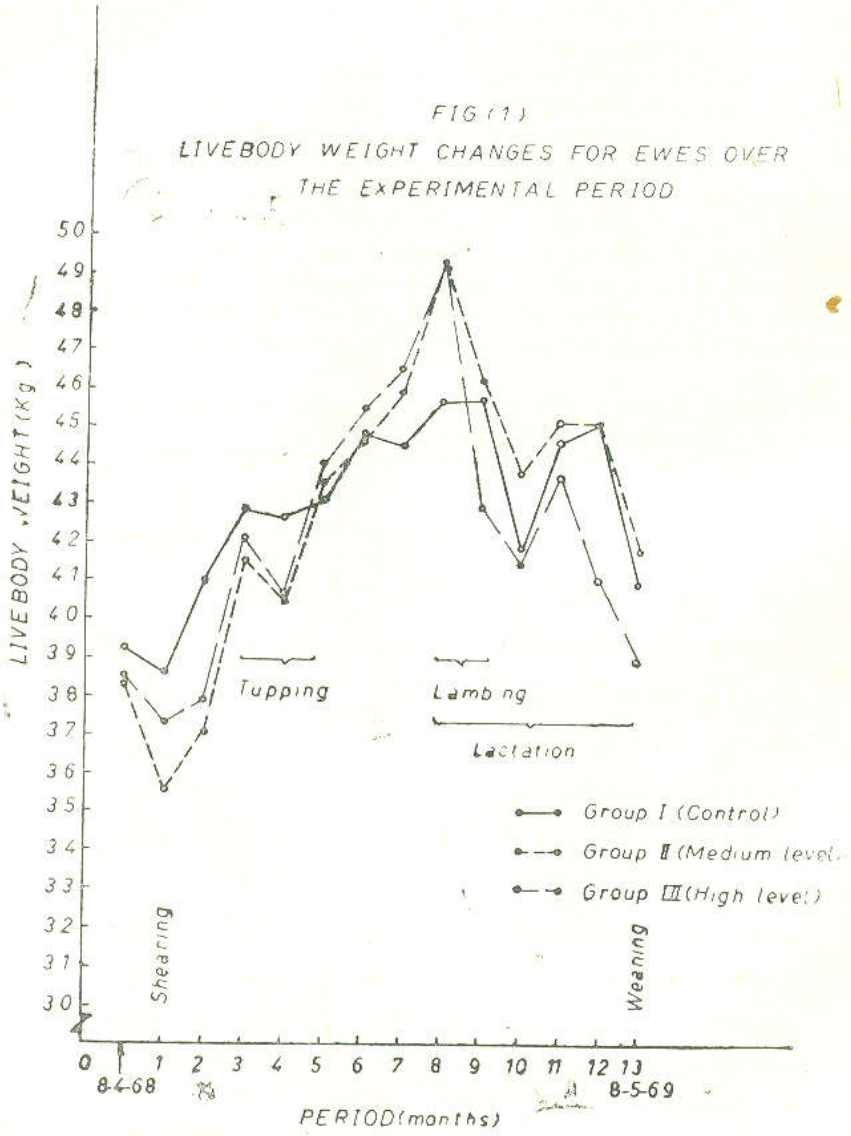
Fig. in parentheses represent the number of animals.

After lambing, the loss in weight corresponded to 1.55, 6.06 and 9.19 kg for ewes of the control, medium and high treatment groups respectively. The ewes are expected to loose weight after lambing equal to the weight of the fetus (s) plus 60% of that weight as embryonic membranes and fluids (Schin kcel, 1963). The difference in live weight loss between the two supplemented groups is probably related to difference in the number of ewes being pregnant and lambed in each group.

Average live weight for the control group maintained fairly constant until a variable time before death at which it declined to 32.46 kg, inspite of the extremely low plasma vitamin A levels and the developing of night blindness. This decline was probably due to the anorexis,spasms and diarrhea,

FIG (1)

LIVEBODY WEIGHT CHANGES FOR EWES OVER THE EXPERIMENTAL PERIOD



which lasted 2–5 days before death as a result of the advanced hypovitaminosis A. These results support the previous findings reported by Franklin, *et al.* (1955) and Peirce (1945).

Mating behaviour and lambing performance

Results of the mating behaviour and lambing performance for the different treatment groups are summarized in Table 2. Fig. 2 shows diagramatically the mating and conception behaviour for ewes of different treatment groups.

TABLE 2. **Mating behaviour and lambing performance of different experimental groups**

Traits	Control	Medium	High	Level of sig.
No. of ewes joined with ram	35	34	34	
No. marked by rams over 51 days period	29	30	31	N.S.
No. conceived	2	21	26	P<0.01
Conception rate %	5%	61%	76%	
No. not marked at all	6	4	3	N.S.
No. of services per conception Oestrus cycle length for single cycles only (day)	21	2.04	1.76	
Mean	16.8	17.6	16.1	N.S.
	(12)	(12)	(14)	
Range	11—20	11—21	10—24	
No. of double cycles	1	1	2	
Gestation period length (day) Mean	—	151.1	150.2	N.S.
		(18)	(25)	
Range	—	148—156	146—155	
No. aborted	2	1	0	N.S.
No. of lambs dropped at full term	0	20	26	P<0.01
No. of stillbirths	0	3	2	N.S.
No. of lambs born alive	0	17	24	P<0.01
No. of neonatal mortalities	0	3	2	N.S.
No. of viable lambs	0	14	22	P<0.01

Fig. in parentheses represent the number of animals.

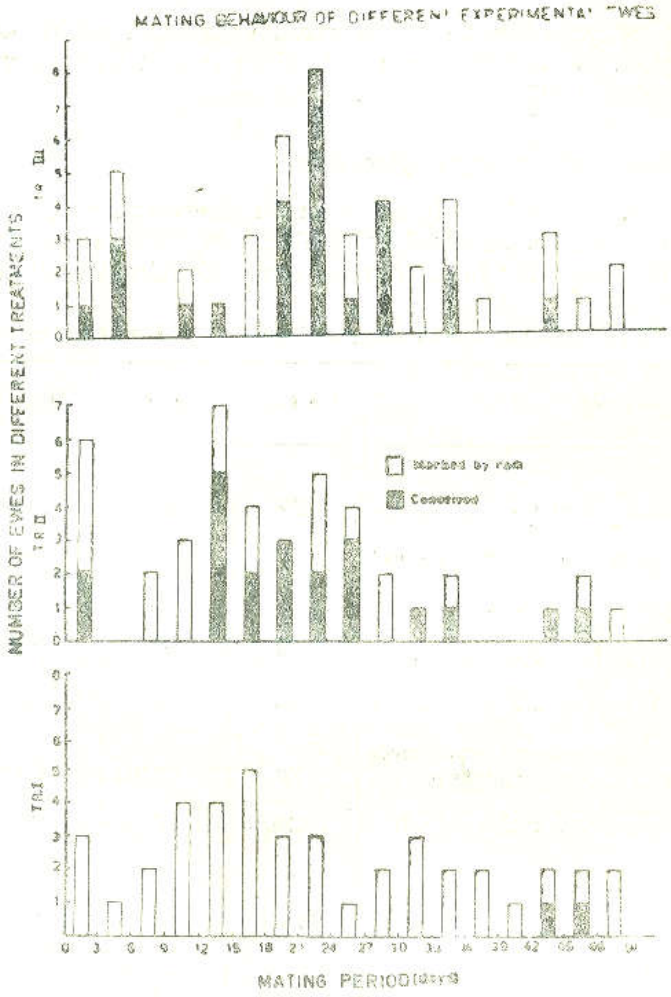


Fig. 2

Heat symptoms were normal and did not differ significantly among different treatment groups over the 51 day mating period ; however, concenption rate differed significantly among the three experimental groups. These findings seems to disagree with those reported by Hart (1940) and Peirce (1954)- who reported that cattle and sheep may show normal heat, ovulation and conception even though they are depleted to the point of night blindness. However, Campbell *et al*, (1958) found that ewes which were developed night blindness, either failed to drop lambs or dropped dead lambs.

Results of this study indicate that vitamin A supplementation was necessary to maintain conception, particularly in the control group.

The number of services required per conception differed among different treatment groups. This result supports the finding reported by Tagwerker (1968) who found that high doses of vitamin A, D and E imporved conception rate at first mating and reduced the number of cows culled for infertility.

The reproductive rate, defined as the number of lambs born alive per 100 ewes bred, was found to be 0, 50 and 70.0% for the control, medium and high treatment groups respectively, differences being highly significant. However, difference between the medium and high group has just failed to reach significance. The number of viable lambs from the medium and high treatment groups differed significantly ($P < 0.05$), due to differences among both groups in the number of stillbirths and neonatal moralities. Ewes recieving low levels of vitamin A or vitamin A-deficient ration during pregnancy are expected to give a corresponding levels in colostrum and milk (Ricketts *et al*., 1956), and this will subsequently affect the viability of the newborn lamsbs.

Two aborted cases occurred in the control group, one in the medium group accompanied by uterus prolapse and death of the ewe ; and non for the high treatment group. This finding supports that of Hart and Guilbert (1933) who found that 75% of the pregnant cows failed to complete pregnancy up to normal calving, when they were fed on dry roughage.

Birth Weight and Weaning Weight of Lambs

Results of birth weight and weaning weight of lambs are shown in table 3. Fig 3 illustrates the corrected live weights for experimental lambs of the medium and high treatment groups from birth up to weaning at weekly intervals. It does not appear that vitamin A supplementation at the high level used in this study was of a favourable effect on birth weight of lambs compared to the medium level, difference between the two groups was not statistically significant.

At weaning, differences did not occur among female lambs of the medium and high treatment groups, however, differences were statistically significant ($P < 0.05$) for males. This is due to the relatively heavier weaning weights of the medium treatment group males. The superiority of the male lambs of the medium group in their growth rates and weaning weights over those from the high treatment group could not be attributed to the vitamin treatment. Part of this superiority howeverver, may be explained on the basis that male lambs of the medium group were relatively heavier at birth as compared to the hight treatment lambs (4.03 *VS*. 3.78 kg). The average live weight of the medium treated ewes which lambed was slightly higher than that of the high treatment group (43.47 *VS*. 39.10 kg), and this might have contributed to the difference in the weaning weights of their lambs.

Results at hand indicate that vitamin A supplementation at two different levels (medium and high) to ewes during pregnancy and lactation did not affect birth weight or weaning weight of lambs. Ricketts *et al*, (1965) reported that growth rate of the newborn lambs up to weaning was not affected by the treatment of their dams with vitamin A.

TABLE 3. Average birth and weaning weight (kg)

Trait	Medium		High	
	♂	♀	♂	♀
Birth weight	4.03	3.58	3.78	3.67
Weaning weight at (120 days old)	25.53	20.25	19.35	20.12

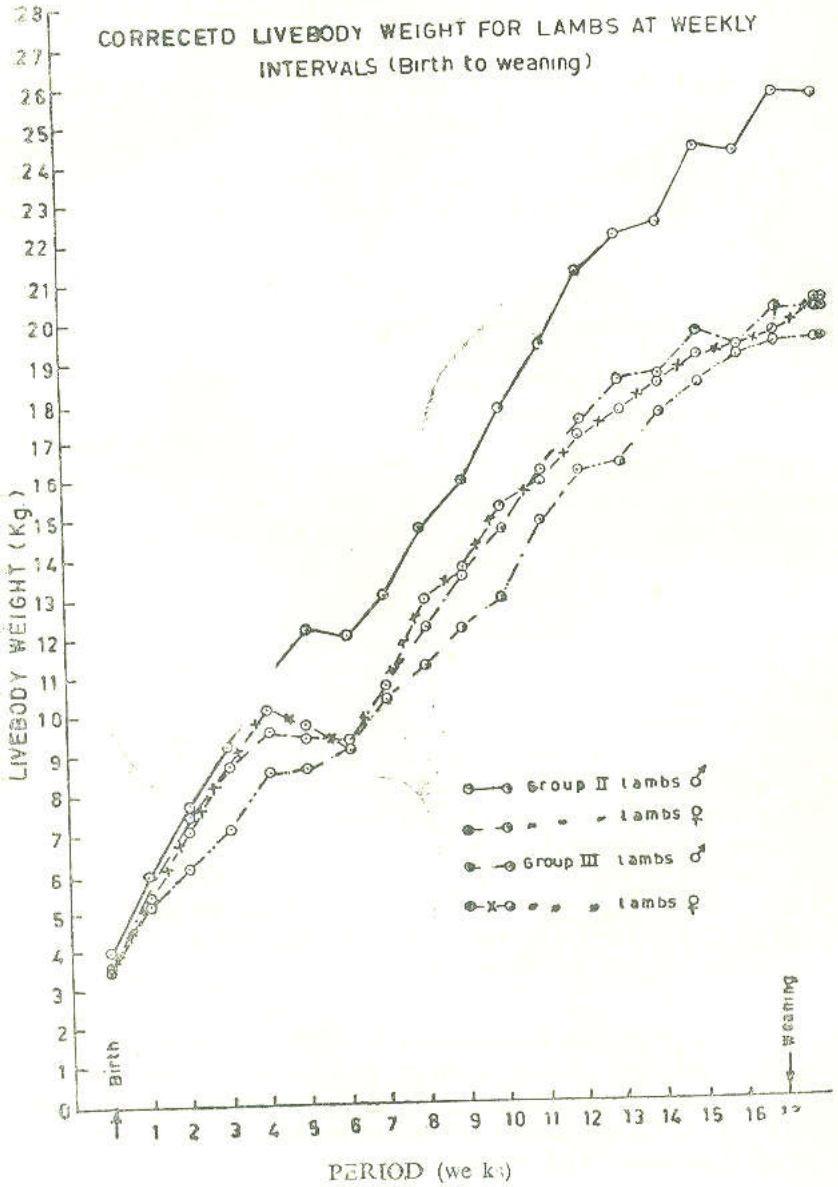


Fig. 3

Mortality of lambs (from birth to weaning)

Results of the mortality of lambs dropped at full term from both supplemented groups are presented in Table 4.

Number of lambs weaned per 100 ewes bred was 35.3% for the medium treatment group as against 55.9% for the high treated one. This result indicates the importance of vitamin A supplementation to ewes at the high level used in this study on the viability of the newborn lambs up to weaning.

Survival rate of lambs, defined as the number of lambs weaned from the number born, was found to be 60% for the medium group as against 73% for the high one. At the 13*th* to 16*th* day before weaning, two lambs from the medium treatment group have developed night blindness which was followed by xeropthalmia, spasms and loss of appetite, then died at the 5*th* to 8*th* day after weaning time.

TABLE 4. **Mortality of lambs from birth to weaning.**

	Medium	High
No. of lambs dropped at full term	20	26
Mortality at birth (stillbirths)	3	2
	(15.0%)	(7.7%)
Mortality up to one week old	6	4
	(30.0%)	(15.4%)
Mortality up to weaning time . . .	8	7
	(40.0%)	(26.9%)

Fig. in parentheses represent mortality as a percentage of the total number born.

Deficiency symptoms and mortality in Ewes

Results of mortality in ewes of different treatment groups from the start of the trial at 3 months pre-mating up to weaning time are present in Table 5. The first mortality case occurred in the control group as a result of vitamin A deficiency, after 161 days from the start of the experiment, then followed by another case after 2 days. Night blindness was observed in three cases from the control group after 126-136 days from the start of the trial. Whereas xerophthalmia and nervous incoordination were developed in five cases after 143-153 days, then, more ewes have developed the same symptoms thereafter.

TABLE 5. Mortality for ewes during experimental period

Stage	Control	Medium	High	level of sig.
Initial number of ewes	35	34	34	
Mortality up to the started of lambing .	6	0	0	P<0.01
(At 22-day from the beginning)	(17.0%)	(0)	(0)	
Mortality up to the end of lambing . . .	13	2*	1	P<0.01
(At 290-day from the beginning)	(37.0%)	(5.8%)	(2.9%)	
Mortality up to weaning time	15	3*	1	P<0.01
(At 395-day from the beginning)	(42.8%)	(8.8%)	(2.9%)	

(*) One was died as a result of uterus prolapse.

Fig. in parentheses represent mortality as a percentage of the total number.

Stages of xerophalmia are illustrated in Fig 4. All ewes died in the control group were suffering from xerophthalmia, nervous incoordination, spasms, anorexia and diarrhea accompanied with a loss in the live body weight. Vitamin A blood plasma level has dropped markedly before death to the level of 10.9 and 1.6 ug per 100 ml after 268 and 298 days respectively on vitamin A-deficient ration. This result indicates that death could occur before reaching the zero level of vitamin A blood plasma. Previous results by Franklin *et al*, (1955) are in agreement with findings of this study.

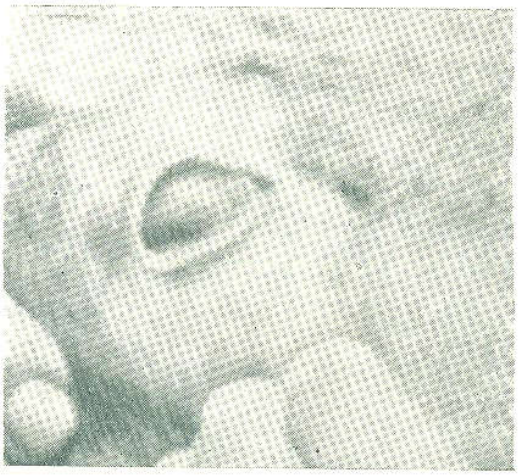
Ewes died from the medium and high treatment groups did not develop any sign of vitamin A deficiency before death. However, vitamin A deficiency was the main cause directly or indirectly of such high mortality rate among ewes of the control group.

Vitamin A blood Plasma Values for Ewes

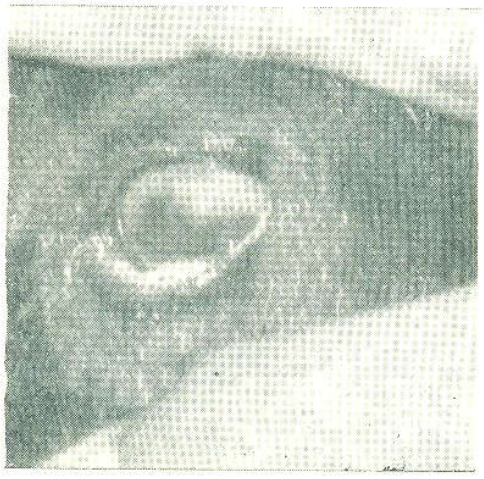
Results in Table 6 show the blood plasma vitamin A level of ewes at monthly intervals over the experimental period, expressed as ug per 100 ml Fig. 5 illustrates graphically the same values. Though sheep of the present study were raised under desert condition, the initial value for vitamin A obtained in this work (33.7 ug/100 ml) falls in the range of 15.6-40.9 ug given by Elmoty and El-Mallo (1957) for sheep raised under the valley condition in Egypt and also in the range of 20-30 ug given by Franklin *et al.* (1955) for sheep as normal level in the blood plasma with adequate reserves in the liver.

The sharp decline in blood plsama vitamin A level at parturition, may be due to the withdrawal of the great amounts of the vitamin from the body in the colostrum and milk. The medium treatment group was more susceptible to the decline of vitamin A level in blood plasma at parturition than the high treated one and this may be due to the difference in the level of supplementation between the two groups.

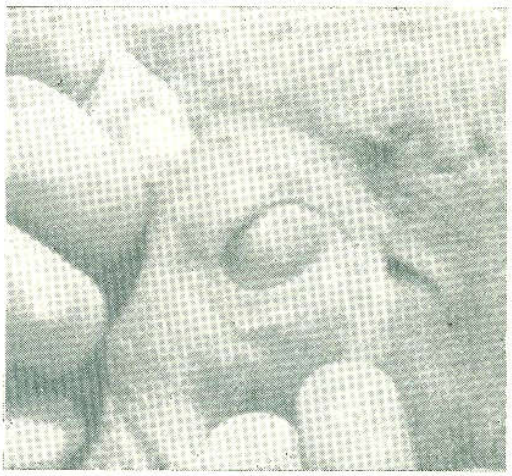
Normal



a) Clouding of the cornea



b) Corneal ulceration



c) Shrinking of the eye ball

Fig. 4. Stages of xerophthalmia

TABLE 6. **Vitamin A blood plasma level of ewes of different treatment groups at monthly intervals over the experimental period.**

Month	ug of vitamin A per 100 ml blood plasma		
	Control	Medium	High
After the 1st dose (24-4-68) . . . . . (before mating)	33.7 (6)	49.2 (6)	51.1 (6)
After the *2nd* dose	31.2 (6)	52.0 (6)	54.8 (6)
After the *3rd* dose	31.0 (6)	57.3 (6)	53.6 (6)
After the *4th* dose (during mating season)	28.8 (6)	55.5 (6)	50.2 (6)
After the *5th* dose	27.4 (6)	53.8 (6)	58.2 (6)
After the *6th* dose (during pregnancy) . .	28.1 (6)	52.0 (6)	59.0 (6)
After the *7th* dose	24.1 (6)	59.1 (6)	72.9 (6)
After the *8th* dose (before lambing)	20.7 (6)	54.6 (6)	66.9 (6)
After the *9th* dose (during lambing) . . .	12.1 (6)	21.9 (6)	59.1 (6)
After *10th* dose (after lambing)	15.4 (5)	27.0 (6)	38.0 (6)
After the *11th* dose	14.4 (5)	84.1 (6)	71.9 (6)
After the *12th* dose (24-3-69) (during lactation)	7.2 (4)	49.5 (6)	49.3 (6)

Fig. in parentheses represent the number of animals sampled.

Recovery of blood plasma level towards normal as compared with the values at parturition occured for the medium and high treatment groups Whereas, the value of the control group has dropped to 7.2 ug per 100 ml. after almost one year of raising the animals on the vitamin -A-deficient ration.

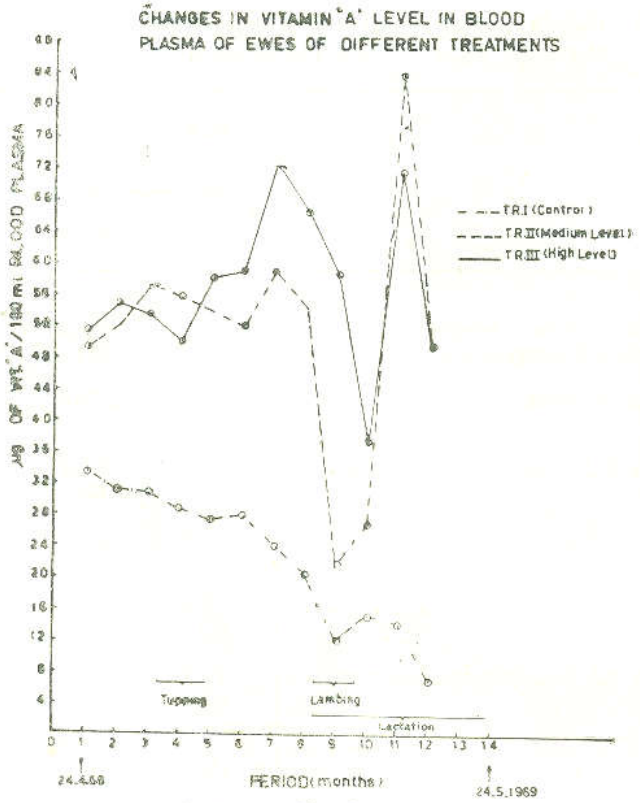


Fig. 5

General Discussion

In the western coastal zone almost one third of the sheep population in Egypt are raised. Sheep raised under such semi-arid conditions are expected to have different manegerial problems from those raised in the valey, mainly due to, differences in the enviroment and type of food. The scarcity of natural food due to the limited grazing season beside the type of dry feeding provided in most part of the year create specific nutritional problems which in turn affect the productivity of such animals. The lack of vitamin A under such feeding conditions is probably one of the biggest problems facing sheep raising in the desert.

The effective role of vitamin A in reporeduction in sheep has been investigated by many workers (Peirce, 1954, Guilbert *et al.* 1937 and Hart and Miller, 1937). There is enough evidence that, lack of vitamin A in the diet of the pregnant ewe, provided that its vitamin A stores are depleted, results in the production of weak, dead or malformed lambs. Results of the present study indicate that vitamin A supplementation was necessary to maintain

conception for ewes raised under desert condition. Though, both the medium and high levels of the vitamin used in this study have prevented symptoms of vitamin A deficiency, the high treated ewes produced significantly more viable lambs compared to the medium treated ones. These results indicate that the existence or absence of the vitamin deficiency symptoms should not be used as a criterion for the determination of the requirements needed for sucessful reproduction. Further work seems to be necessary to estimate the optimal dose of the vitamin needed for the prevention of night blindness, reproduction and other special demonds. It may be necessary as well to determine in a further work the optimum period of supplementation and the most practical way of administration. Vitamin A was administreted orally for the supplemented ewes of this study and it may be easier for practical purposes to be administreted in a powder form with the ration during the dry season or by injection.

In this study it was not possible to determine the role of vitamin A in the different stages of the reproductive cycle and this would deserve further work. From the results of this study as well as that of Ghanem (1967), it may be concluded that supplementation of ewes with vitamin A (100,000 iu/ head/month) is necessary under desert conditions to avoid such high losses in fertility and general health.

References

Campbell, F.R., Livingston, C.W. Jr., Shelton, M. and Jatkins, T.D (1958). Influence of vitamin A on wool growth Wool Strength and reproductive performance in Rambouil let ewes (abstr.). *J. Anim. Sci.*, **17**, 1194.

Elmoty, I.A. and El-Malla, A.A. (1957). Seasonal vitamin A and Carotenoid level in the blood plasma of Egyptian sheep. *Acta. Vet. Hung.*, **17**, 147.

Franklin, M.C., Mc Clymont, G.L., Briggs, P.K. and Campbell. B.L (1955). Maintenance rations for Merino Sheep. II. The performance of weaners fed daily and weekly on rations of wheat and wheaten chaff at maintenance levels and the effect thereon of vitamin A supplements. *Austr. J. Agric. Res.*, **6**, 324.

Ghanem, Y.S. (1967). The effect of vitamin A deprivation on the reproductive performance of Merinon and Barki ewes under desert condtions. Bull. inst. Desert, **13**, 89

Glick, D (1957). *„Methods of biochemical analysis"*. 1*st* ed. Interscience Pub. Co. Inc. New York.

Guilbert, H.R., Miller, R.F. and Hugues, E.H. (1937). The minimum Vitamin A and Caro tene requirements of cattle, sheep and swine. *J. Nutrit.* **13**, 543.

Hart, G.H. (1940). Vitamin A deficiency and requirements of farm mammals, A *review, Nutrit. Abstr. and Reviews*, **10**, 261.

Hart, G.H. and Guilbert, H.R. (1933). Vitamin A deficiency as related to reproduction in cattle. *Calif. Agr. Exp. Stat. Bull*, No. 560, 30 pp.

Hart, G.H. and Miller, R.F.(1937). Relation of certain dietary essentials to fertility in sheep. *J. Agric. Res.*, **55**, 47.

Kimble, M.S. (1939). Photometric determination of Vitamin A and carotene in human plasma. *J. Lab. Clim. Med.*, **24**, 1055.

Morrison, F.B. (1955). *"Feeds and feeding"*. 22*nd* ed., The Morrison Publ. Co. Clinton Iowa.

Peirce, A.W. (1945). The effect of the intake of carotene on the general health and on the, concentration of Carotene and of Vitamin A in the blood and liver of sheep. Aust. *J. Exp. Biol. Med. Sci.* **23**, 295.

Pierce, A.W. (1954). The effect of intake of carotene on reproduction in sheep. *Aust. J. Agric. Res.*, 5, 470.

Ricketts, G.E., Bell, D.S., Johnson, R.R. and Moxon, A.L. (1965). Iron and Vitamin A as treatments in the nutrition of newborn lambs. *J. Anim. Sci.*, **24**, 748.

Schinckel, P.G. (1963). The potential for increasing efficiency of feed utilization through newer knowledge of animal nutrition (C\ Sheep and goat. *World Conf. on Anim. Prod., Rome*, 1, 199. *European Assoc. for Anim. Prod.*

Snedecor, G. (1956). *„Statistical Methods"*. 5*th* ed. The Iowa State University, Ames. Iowa.

Steel, R.G.D. and Torrie, J.H. (1960). *"Principles and Procedures of Statistics"*. Mc-Graw-Hill Book Co., Inc. New York.

Tagwerker, F.J. (1968). Vitamin supply and disorders of reproduction in cattle. *Schweiz. Arch. Tierheilk.*, 110, 372, (*N.A.R.*, 39, 3856) (abstr.).

تأثير اضافة فيتامين (أ) على انتاجية النعاج تحت الظروف الصحراوية

عبد المنعم سعود ، أحمد يونس ، محمد العشرى ، عثمان شحاته .
قسم الانتاج الحيوانى . معهد الصحراء .

أجريت تلك التجربة فى محطة أبحاث رأس الحكمة التابعة لمعهد الصحراء واستخدم فيها ١٠٣ نعجة (عواس وبرقى وخليط) من أعمار مختلفة لدراسة تأثير اضافة فيتامين أ على خصوبة النعاج تحت الظروف الصحراوية . قسمت نعاج التجربة عشوائيا الى ثلاث معاملات . الاولى أعطيت ١٠٠ر٠٠٠ وحدة دولية من فيتامين أ لكل رأس شهريا والثانية أعطيت ٥٠ر٠٠٠ وحدة دولية لكل رأس شهريا والمجموعة الثالثة تركت بدون معاملة . بدأ اعطاء الفيتامين ثلاثة شهور قبل موسم التلقيح واستمر حتى الفطام . غذيت كل المجاميع على نفس العليقة الفقيرة فى فيتامين أ (عليقة مركزة وتبن) تبعا لمقررات موريسون وكانت النتائج كالآتى :

١ ــ ظهر أعراض نقص الفيتامين على المجموعة التى تركت بدون معاملة فى صورة العشى الليلى عند اليوم ١٢٦ ــ ١٣٦ من بدأ التجربة ثم حدثت بقية الأعراض بعد ذلك وظهرت أول حالات النفوق عند اليوم ١٦١ وقد ظللت الحيوانات محتفظة بوزنها ثابتا حتى قبل النفوق بحوالى ٢ ــ ٥ يوم حيث انخفض الوزن الحى انخفاض ملحوظ فى حين لم تظهر أعراض نقص الفيتامين على نعاج المجموعتين الأخرتين . وكانت معدلات النفوق هى ٤٢ر٨ ، ٨ر٨ و ٢ر٩٪ فى النعاج المقارنة والتى أعطيت المستوى المتوسط والتى أعطيت المستوى العالى من الفيتامين على التوالى .

٢ ــ لم تؤثر المعاملات تأثيرا معنويا على نسبة النعاج التى لقحت فى خلال فترة التلقيح .

٣ ــ كان معدل الخصوبة ٥٪ ، ٦١٪ ، ٧٦٪ لكل من النعاج المقارنة ونعاج المستوى المتوسط والعالى على التوالى وكانت الفروق بينهما معنوية على مستوى ١٪ . كذلك أعطيت المجموعة الأخيرة عددا أكبر من الحملان المفطومة بالمقارنة بالمجموعة الثانية .

٤ ــ لم تؤثر المعاملات على وزن الحوالى عند الميلاد أو عند الفطام .

٥ ــ بلغت نسبة النفوق فى حوالى المجموعة ذات المستوى العالى ٣٦ر٩٪ مقابل ٤٠٪ لحوالى المجموعة ذات المستوى المتوسط .