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Reproductive Performance of Giza Rabbit Does Under Different Natural and Artificial Environmental Conditions

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THE STUDY was carried out to disintegrate the effect of major seasonal factors, temperature, light and nutrition on reproductivity of rabbits. 48 does were used to study the effect of these factors under artificial conditions : fluctuating air temperature (simulation of summer) (24°-30°) ; sustained high air temperature (35°) ;long term diurnal light (14 hr / day) and dry roughage feeding compared to conrol natural winter conditions.

The main results of the study are :

1. Feeding does on Berseem hay during winter instead of green Berseem caused delay in their acceptance to mating for several hours.

2. Severe sustained heat stress of 35° reduced the conception rate from 66 % in the Ist parity to 33 % in the 2nd parity against 100 % conception in animals subjected to extended light (14 hr/ day).

3. Reduction in the litter size of the 2nd parity, high percentage of still births (9 %) and high mortality rate of offsprings (31.8 % and 25 % in the Ist and 2nd parity respectively) were observed in animals subjected to severe heat stress of 36 °.

4. Berseem hay feeding (during winter) instead of green Berseem resulted in complete failure of producing alive offsprings in the 2nd parity.

The study proved that the failure of natural raising of rabbits in summer is not due to hot conditions or long day light as traditionally considered but rather to some difficient elements in summer feeds.

Several studies on rabbits have indicated that there are seasonal difference in: ovulation rate (Johanson and Fulka, 1966 and Hahn and Gabler, 1971) ; implantation rate (El-Fouly *et al.*, 1977) ; gestation period (Bruce and Abdull Karim, 1973 and El-Fouly *et al.* 1977); fetal weight and length (Radwan, 1975) and litter size (El-Khishin *et al.*, 1951 ; Ghany *et al.* 1961 ; Ragab and Wanis, 1963 and Hammond, 1965).

Estimates for these characteristics were obviously high during summer and spring in temperate zones but during winter and spring in subtropical zones.

The low reproductive activity of rabbits in Egypt during summer is attributed to integrated complex of factors, particularly, hight ambient temperature, long diurnal light and low plane of nutrition.

This work was conducted to disintegrate the effect of these seasonal factors experimentally and to evaluate the effect of each factor on the reproductive performance of rabbits.

Material and Methods

This work was carried out in the Research Station, Animal Production Department Faculty of Agriculture, Cario University, Giza, Egypt during the period from January 1978 till may 1979. A total of 48 adult does of native, White Giza, rabbits and 12 bucks with good fertility record were used.

The study comprised two experiments. In the first experiment, 18 does were divided at random into the following three equal groups :

Group	Conditions
I. Control	Natural temperature and light (Winter conditions).
II. Extended light	14 hours daily light by excess artificial lighting.
III. Sustained severe heat stress.	Sustained high air temperature (35°C).

In the second experiment 30 does were divided at random into five equal groups according the following plan :

Group	Conditions
I. Control*	Natural temperature and light and green Berseem as the major feed (Winter Conditions).
II. Extended light	Natural temperature + 14 hr light / day.
III. Fluctuating heat** stress.	Fluctuating temperture (24– 30°C/day), natural light.
IV. F. Heat + E. Light	Fluctuating temperature + 14 hr light/day.
V. Hay-feeding°	As control except that green Berseem was replaced by Berseem hay.

* Air temperature of the control rooms (Natural winter conditions) had a mean value 21.6 ± 0.97°C and 20.7 ± 0.80°C from the begining till the end of the two experiments.

** Air temperature went up during the day to reach a maximum of 30°C and dropped down during night to reach 24°C. This is almost simulation of summer air temperature.

° Each doe in group V was fed daily 30gm of Berseem hay instead of 150 gr. green Berseem in other groups.

The relative humidity was about 50% in the heated rooms and about 56% in the other rooms.

The animals of each group were kept to give two successive parities (around 3 months) under their particular designed conditions.

Results and Discussion

Receptivity to mating

Increasing light artificially to 14 hr daily (summer natural period) did not affect the acceptance of does to coitus than that of control group. Also raising environmental temperature to a level similar to that of summer (24° 30°) did not affect mating response. Moreover sustained heat stress at 35° did not have any effect. However combination of long light and hot conditions caused delay in the acceptance of half the does to mating but only for several minutes.

The group under natural light and temperature (winter conditions) but having Berseem hay feed instead of green Berseem showed a marked delay for several hours in acceptance of mating. These results show that the nutritional conditions play an important role in sexual receptivity and had a higher effect than the heat stress or light period. Hammond (1925) stated that female rabbits are always being in a condition of oestrus when conditions of nutrition are favorable, short dioestrous periods may, however, occur during the breeding season when does refused the male, possibly as a result of adverse nutritional conditions.

Conception rate

During the first experiment the conception rate for the first parity was equal for the does under the different conditions 66% for each group. In the second parity, after 1·5-2 months, the conception rate dropped to 33% in the heat stressed group (35°) while it reached 100% in the lighted group (14 hr/day) (Table 1). Benson and Morris (1971) reported that 9·7% of rats surviving exposure to 37° failed to give litter. During the second experiment, the less severe heat stress (daily 24-30°) caused a slight reduction in conception. Hay feeding caused a great reduction in conception particularly in the second parity (Table 2). For unknown reason the combined treatment of fluctuating heat plus extended light was accompanied with the least conception rate in the second parity (Table 2).

Litter Size

The severe sustained heat stress (35°) caused a great reduction in the litter size particularly in the 2nd parity (Table 3). The fluctuating heat stress did not affect litter size Sittmann *et al.* (1964) stated that when the average daily maximum temperature was higher than 80° F (26.6°), the average number born alive per litter was 6·74, in New Zealand rabbits, which is equal to the present result at 24-30° .

TABLE 1. **Conception rate, litter size, number of still-birth and mortality % until weaning in rabbits under different environmental conditions during the first experiment.**

Parity	Treatment *	No. pregnant does	Total litter size	Total born		No. at weaning	Mortality % till weaning
				Still-birth	Normal		
1	Control	4	29	0	29	24	17.2
	Extended light (14 hrs)	4	17	0	17	13	23.5
	Sustained heat (35°)	4	22	2	20	13	31.8
2	Control	5	42	0	42	35	17.7
	Extended light	6	34	0	34	29	14.7
	Sustained heat	2	8	0	8	6	25.0

* 6 does in each treatment.

Hay feeding instead of green Berseem caused a harmful effect on litter size-particularly in the 2nd parity similar to that caused by severe heat stress (Table 3). This effect is most probably due to deficiency in vitamin A. Hahn and Maercklin (1972) reported that lack of carotine or vitamin A caused the relative low percentage of fertilized ova and viability of implanted zygote.

Increasing the daily light to 14 hr induced contradicting results. While it reduced litter size in the 1st experiment, it caused clear increase during the second experiment either alone or with fluctuating heat stress (Table 3).

Still-birth and mortality rate until weaning

In the first parity sustained heat stress produced 9% still-births of total born while non occurred in the control and lighted groups (Table 1). This effect of heat stress did not occur in the second parity probably due to adaptation of does. to heat stress, and / or to the reduction in the litter size.

The highest value for mortality percentage until weaning (31.8%) was recorded in the sustained heat stressed group followed by lighted group. The lowest value was found in the control group, this could be due to, (a) direct effect of heat stress on the sensitive young offsprings, (b) heat exposure might have reduced milk production of dams due to general depression of metabolic activity under heat stress.

TABLE 2. Conception rate, litter size, number of still-birth and mortality % until weaning in rabbits under different environmental conditions during the second experiment.

Parity	Treatment*	No. pregnant does	Total litter size	Total born		No. at weaning	Mortality % till weaning
				Still-birth	Normal		
1	Control	6	36	–	36	31	13.9
	Extended light (14 hr)	6	40	–	40	37	7.5
	Fluctuating heat (24-30°C)	5	34	1	34	33	2.9
	F. Heat & E. light	5	32	–	32	32	0.0
	Hay feeding	5	25	–	25	23	8.0
2	Control	5	32	–	32	28	12.5
	Extended light (14 hrs).	4	28	–	28	27	3.6
	Fluctuating heat	5	31	1	30	28	6.5
	F. Heat & E. light.	3	26	1	25	22	11.5
	Hay feeding	4	18	18	0	—	—

* 6 does in each treatment.

The mortality of youngs in heat stressed group decreased from 31.8 to 25.0% in the first and second parity respectively apparently to the great reduction in litter size and milk production. Another cause seems to be that the does being pregnant (only 2 out of 6) (Table 1) were the most efficient ones which are probably of good mothering ability.

The less severe fluctuating heat stress (24-30° day), simulation of summer weather in Egypt, caused a lower proportion of still-birth about 3% in both Ist and 2nd parity (Table 2). The mortality rate under this level of heat stress was less even than in the control group (Table 2).

The light treatments in general caused a reduction in mortality rates than in control groups.

TABLE 3. **Litter size given by rabbits under different environmental conditions in the first and second parity during the first and second experiments.**

Expt.	Treatment	Average litter size	
		1*st* parity	2*nd* parity
1*st*	Control	7.3	8.4
	Extended light (14 hr)	4.3	5.7
	Sustained heat (35°)	5.5	4.0
2*nd*	Control	6.0	6.4
	Extended light (14 hr)	6.7	7.0
	Fluctuating heat (24 – 30°)	6.8	6.2
	F. Heat + E. Light	6.4	8.7
	Hay feeding	5.0	4.6

The hay fed group had a low rate of mortality in their offsprings (8%), in the second parity, however, the does did not succeed in producing alive offsprings (Table 2).

Conclusion

The study proved that the failure of natural raising of rabbits in summer is not due to hot condition or long daylight as traditionally considered but rather to some defficient elements in summer feeds. Vitamin A difficiency in dry roughage is expected to be the most effective factor.

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تأثير العوامل البيئية الطبيعية والصناعية على الظواهر التناسلية لارانب الجزيزه الابيض

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أجرى هذا البحث بهدف دراسة تأثير عوامل الصيف البيئية تجريبيا من حرارة جوية متغيرة (٣٠°م نهارا ، ٢٤°م ليلا) ، حرارة مرتفعة (٣٥°م) مستمرة، نهار طويل (١٤ ساعة اضاءة يوميا) والتغذية على مواد خشنة جافة على الظواهر التناسلية فى الأرانب ٠

وقد استخدمت فى التجربة ٤٨ أنثى أرانب جيزة أبيض ٠

وتتلخص أهم النتائج فيما يلى :

١ ـ أدت تغذية الاناث على دريس البرسيم بدلا من البرسيم الأخضر الى تأخر استجابة الاناث للتلقيح لعدة ساعات ٠

٢ ـ تسبب تعرض الاناث للحرارة المرتفعة (٣٥°م) المستمرة الى خفض معدل الاخصاب من ٦٦٪ فى البطن الأولى الى ٣٣٪ فى البطن الثانية بينما وصل معدل الاخصاب ١٠٠٪ عندما تعرضت الاناث لـ ١٤ ساعة اضاءة يومية تحت ظروف الشتاء الطبيعية ٠

٣ ـ تسبب الحرارة المرتفعة (٣٥°م) المستمرة فى انخفاض كبير فى عدد الخلفة المولودة فى البطن الثانية ، زيادة معدل النفوق عقب الولادة مباشرة أو المولود نافقا الى ٩٪ وارتفاع معدل النفوق حتى الفطام (٣١٫٨٪ ، ٢٥٪ فى البطن الأولى والثانية على التوالى) ٠

٤ ـ أدت التغذية على دريس البرسيم بدلا من البرسيم الأخضر الى فشل الأمهات التام فى ولادة خلفة حية فى البطن الثانية ٠

وقد أثبتت التجربة أن السبب فى فشل تربية الأرانب فى مصر صيفا لا يرجع الى ارتفاع درجة الحرارة أو الى طول فترة الاضاءة كما كان معتقدا بل الى نقص فى عناصر غذائية معينة فى الغذاء الصيفى ٠ وقد يكون نقص محتوى الدريس من فيتامين أ أكثر هذه العوامل تأثيرا ٠