

RESULTS AND DISCUSSION

A- HEAT TOLERANCE TRAITS

1. Body Temperature

a. Body Temperature in Does

The overall means of body temperature in Giza White, Bauscat and Grey Flander rabbits were 38.87, 39.90 and 38.91°C, respectively, in the morning and 39.04, 40.04 and 39.06°C, respectively, in the afternoon (Table 3). Both Giza White and Grey Flander does were nearly of the same body temperature (about 39°C) in the morning and in the afternoon. Body temperature of Bauscat was higher than that of does of any of the other two breeds by one degree centigrade in both times of measurement. does

Means of the morning and afternoon body temperatures in the three breeds showed a tendency indicating that afternoon body temperature was slightly higher than morning body temperature. This may be due to the fact that the average of annual afternoon air temperature (24.70°C) was higher than that of morning air temperature (20.45°C).

Month:

Tables 3 and 4 show that month differences in body temperature of does were highly significant ($P < 0.01$) in

Table (3): Least squares constants + standard errors of factors affecting body temperature in does.

Classification	Y	CIZA WHITE				BAUSCAT				GRAY FLANDER			
		Morning		Afternoon		Morning		Afternoon		Morning		Afternoon	
		Const.	± S.E.	Const.	± S.E.	Const.	± S.E.	Const.	± S.E.	Const.	± S.E.	Const.	± S.E.
General mean	290	38.87	± 0.07	39.04	± 0.04	450	39.90	± 0.21	40.04	± 0.21	211	38.91	± 0.04
Month:													
October (21.7°C.) ²	35	-0.05	± 0.07 ab	-0.16	± 0.08 ab	55	-0.80	± 0.37 a	-0.78	± 0.37 a	25	-0.07	± 0.08 ab
November (19.5°C.)	30	-0.17	± 0.07 b	-0.24	± 0.08 b	50	-0.79	± 0.37 a	-0.80	± 0.36 a	25	-0.05	± 0.08 ab
December (14.6°C.)	26	-0.13	± 0.07 bc	-0.27	± 0.08 b	42	-0.63	± 0.39 a	-0.75	± 0.38 a	20	-0.21	± 0.09 b
January (12.5°C.)	26	-0.02	± 0.07 a	-0.06	± 0.08 bd	42	-0.84	± 0.39 a	-0.83	± 0.38 a	20	-0.08	± 0.08 ab
February (15.1°C.)	26	0.00	± 0.07 a	-0.09	± 0.08 bc	42	-0.57	± 0.39 a	-0.56	± 0.37 a	20	0.04	± 0.08 ab
March (20.2°C.)	26	0.03	± 0.07 a	0.05	± 0.08 ade	42	-0.11	± 0.38 a	-0.07	± 0.37 a	20	-0.04	± 0.09 ab
April (24.5°C.)	30	-0.01	± 0.07 a	0.03	± 0.07 ade	48	-0.20	± 0.37 a	-0.20	± 0.36 a	21	-0.01	± 0.09 ab
May (26.9°C.)	31	0.03	± 0.07 a	0.11	± 0.07 cde	49	-0.13	± 0.36 a	-0.09	± 0.35 a	21	0.04	± 0.08 ab
June (29.9°C.)	24	0.14	± 0.07 a	0.28	± 0.08 of	35	0.04	± 0.41 a	0.09	± 0.40 a	16	0.10	± 0.09 a
July (28.8°C.)	24	0.07	± 0.07 ac	0.18	± 0.08 cd	30	0.15	± 0.44 a	0.18	± 0.43 a	16	0.12	± 0.09 a
August (29.5°C.)	12	0.11	± 0.10 ab	0.17	± 0.11 cde	15	3.88	± 0.61 b	3.89	± 0.59 b	7	0.16	± 0.14 ab
Weight of doe													
≤ 2500 grams	139	-0.04	± 0.03 a	-0.03	± 0.03 a	183	0.16	± 0.14 a	0.14	± 0.13 a	73	-0.03	± 0.03 a
> 2500 grams	151	0.04	± 0.03 a	0.03	± 0.03 a	267	-0.16	± 0.14 a	-0.14	± 0.13 a	138	0.03	± 0.03 a
Age of doe													
8 - 12 months	84	0.01	± 0.04 a	0.04	± 0.05 a	112	0.64	± 0.24 a	0.64	± 0.23 a	40	0.13	± 0.06 a
> 12 - 24 months	128	0.02	± 0.03 a	0.00	± 0.04 a	229	-0.48	± 0.19 bc	-0.46	± 0.18 bc	86	-0.07	± 0.05 bc
> 24 months	78	-0.03	± 0.04 a	-0.04	± 0.04 a	109	-0.16	± 0.20 c	-0.18	± 0.19 c	85	-0.06	± 0.04 c
Reproductive status:													
Pregnancy	69	-0.05	± 0.03 a	-0.05	± 0.03 a	120	0.29	± 0.16 a	0.28	± 0.16 a	66	0.03	± 0.03 a
No pregnancy	201	0.05	± 0.03 a	0.05	± 0.03 a	330	-0.29	± 0.16 a	-0.28	± 0.16 a	145	-0.03	± 0.03 a
Suckling status:													
Suckling	76	-0.04	± 0.03 a	-0.03	± 0.04 a	112	0.51	± 0.17 a	0.50	± 0.16 a	60	-0.01	± 0.03 a
No suckling	214	0.04	± 0.03 a	0.03	± 0.04 a	338	-0.51	± 0.17 b	-0.50	± 0.16 b	151	0.01	± 0.03 a

1 Constants, within the same classification, followed by different letters are significantly different ($P < 0.05$), otherwise they are not.
 2 Average air temperature.

(The same notations are followed in similar tables).

Table (4): Least squares analysis of variance of factors affecting body temperature in does.

Source of variation	GIZA WHITE						BAUSCAT						GREY FLANDER					
	Morning			Afternoon			Morning			Afternoon			Morning			Afternoon		
	d.f	Mean square	Variance %	Mean square	Variance %	d.f	Mean square	Variance %	Mean square	Variance %	d.f	Mean square	Variance %	Mean square	Variance %	d.f	Mean square	Variance %
Month	10	0.1662	1.23	0.5428	8.82	10	28.0200	7.67	27.4805	7.88	10	0.1481	0.00	0.4181	12.47			
Weight of doe	1	0.2629	0.94	0.2210	0.34	1	8.1476	0.13	6.1418	0.00	1	0.1013	0.00	0.0255	0.00			
Age of doe	2	0.0519	0.00	0.0704	0.00	2	27.6135	2.78	26.5448	2.77	2	0.4007	2.98	0.1493	0.00			
Reproductive status.....	1	0.4191	2.91	0.3389	1.51	1	19.0691	1.45	18.2370	1.52	1	0.1290	0.00	0.0940	0.00			
Suckling status 1		0.1710	0.44	0.0919	0.00	1	57.7838	6.22	56.4945	6.36	1	0.0143	0.00	0.0922	0.00			
Residual	274	0.1286	94.48	0.1629	89.33	434	6.1845	81.75	5.8894	81.47	195	0.1465	97.02	0.1218	87.53			

* P < 0.05

** P < 0.01

The same notation are followed in similar tables.

the afternoon in all used breeds, and only significant ($P < 0.05$) in the morning in Bauscat breed. The averages of morning (38.96°C) and of afternoon (39.09°C) body temperature in winter months (October-March) were relatively lower than their respective values (39.53 and 39.74°C) in summer months (April-August). This may be due to the fact that the average of annual air temperature in summer months (27.89°C) was higher than that of winter months (17.06°C). Results of the present work seem to be in agreement with those of Shafie *et al.* (1970) who reported that maximum values of body temperature in Giza White rabbits were observed during summer months (June-August).

The difference in body temperature between winter and summer months was higher in Bauscat does (1.4°C .) than in either Giza White (0.21°C) or Grey Flander does (0.21°C). This may be due to the long time of both natural and artificial selection in Giza White rabbits for adaptation to the Egyptian weather conditions. Also, the hair and skin of Grey Flander are dark in colour and this facilitates heat dissipation from body core and surface and reduces the internal and external body temperature consequently (Abdel-Malek, 1967).

Body weight:

Constants presented in Table 3 show that body temperature of heavy does (> 2.5 kg) was slightly lower than that

of light does (≤ 2.5 kg). The same trend was also detected when considering the average of morning and afternoon body temperatures of heavy and light does in all breeds of study (39.27°C and 39.34°C , respectively). The differences in both morning and afternoon body temperature due to weight of doe were, however, not significant in all breeds (Table 4). Accordingly, it seems that weight of doe within a breed has no effect on its body temperature.

Age of doe:

Results on the effect of age of doe on body temperature indicate that does with the first category (8-12 months) recorded higher body temperature than those of older ages either in the morning or in the afternoon for any of the breeds of the study (Table 3). The same observation was obtained when considering the averages of the means of morning body temperature for does of 8-12 months old and for does of more than 12 months (39.49 and 39.10°C , respectively) and the corresponding averages of afternoon body temperature (39.63 and 39.26°C , respectively). Differences in body temperature due to age of doe did not reach significance except for Bauscat does in the morning and in the afternoon (Table 4). These results are in agreement with those reported by Abdel-Malek (1967) and Kamar *et al.* (1970) who found that body temperature of Giza White rabbits was decreased slightly by advance in age. The relatively higher body temperature of young does may be attributed to

irritability and restlessness with the experience of pregnancy (Hassanein, 1980).

Reproductive status:

Constants of reproductive status refer to a higher body temperature in the morning and in the afternoon for pregnant does than for non-pregnant ones in Bauscat and Grey Flander rabbits, but a reversible observation was obtained for Giza White does (Table 3). The average of the least squares means of the three breeds showed that pregnant does recorded higher temperature than non-pregnant in the morning (39.32 vs 39.14°C) and in the afternoon (39.47 vs 39.29°C). Although differences due to reproductive status were non-significant, yet the results gave evidence for higher body temperature in pregnant does than in non-pregnant ones. This appears to be, also, in agreement with results reported on Giza White rabbits by Hassanein (1980) who showed that body temperature in pregnant does was more than in non-pregnant ones.

Suckling status:

Tables 3 and 4 show non-significant effects of suckling status on body temperature of both Giza White and Grey Flander rabbits. This effect was, however, highly significant ($P < 0.01$) in Bauscat; in which the suckling does have

higher body temperature than non-suckling ones by about 1.0°C. In this respect, Abdel-Malek (1967) and Hassanein (1980) in Giza White rabbits, found that suckling had non-significant effect on body temperature.

b- Body Temperature in Offspring

The overall means of body temperatures, in the morning and in the afternoon, at different ages of Giza White , Bauscat and Grey Flander rabbits are presented in Tables 5, 7 and 9, respectively. These means show that both Giza White and Bauscat rabbits were nearly of the same body temperature in the morning and in the afternoon at all ages. The Grey Flander rabbits, however, had a relatively lower morning and afternoon body temperatures in all comparable ages. This may be due that both Giza White and Bauscat rabbits are of the same white colour; while Grey Flander rabbits have a dark coat. The dark pigments in the coat facilitate heat exchange, so that reduces the internal and external body temperature (Abdel-Malek, 1967).

There is a tendency, in all breeds, showing that afternoon body temperature at different ages was higher than that of the morning by about $0.15-0.20^{\circ}\text{C}$. This is due to the fact that the average of annual afternoon air temperature (24.70°C) was higher than that of morning air temperature (20.45°C).

Means of body temperature of rabbits change slightly with advance in age but did not show any constant trend.

Sex:

The statistical analysis of sex effect on body

Table (5): Least squares constants $\pm$ standard errors of factors affecting body temperature in offspring of Giza White rabbits.

Classification	Weaning			6 Weeks			8 Weeks			10 Weeks			14 Weeks			16 Weeks		
	N	Const.	$\pm$ S.E.	N	Const.	$\pm$ S.E.	N	Const.	$\pm$ S.E.	N	Const.	$\pm$ S.E.	N	Const.	$\pm$ S.E.	N	Const.	$\pm$ S.E.
Morning temperature																		
General mean	121	39.26	$\pm$ 0.02	112	39.21	$\pm$ 0.03	103	39.24	$\pm$ 0.03	93	39.22	$\pm$ 0.04	51	39.51	$\pm$ 0.13	40	38.97	$\pm$ 0.12
Sex:																		
Male	56	0.02	$\pm$ 0.02 a	51	-0.01	$\pm$ 0.02 a	45	0.02	$\pm$ 0.01 a	42	0.03	$\pm$ 0.01 a	16	0.03	$\pm$ 0.04 a	11	-0.02	$\pm$ 0.04 a
Female	65	-0.02	$\pm$ 0.02 a	61	0.01	$\pm$ 0.02 a	58	-0.02	$\pm$ 0.01 a	51	-0.03	$\pm$ 0.01 b	35	-0.03	$\pm$ 0.04 a	29	0.02	$\pm$ 0.04 a
Air temperature:																		
< 20 °C.	48	-0.03	$\pm$ 0.02 a	19	-0.04	$\pm$ 0.04 a	14	0.03	$\pm$ 0.02 a	14	-0.05	$\pm$ 0.02 a	3	-0.03	$\pm$ 0.09 a	1	-0.06	$\pm$ 0.10 a
$\geq$ 20 °C.	73	0.03	$\pm$ 0.02 a	93	0.04	$\pm$ 0.04 a	89	-0.03	$\pm$ 0.02 a	79	0.05	$\pm$ 0.02 b	48	0.03	$\pm$ 0.09 a	39	0.06	$\pm$ 0.10 a
Season:																		
December-February	25	0.05	$\pm$ 0.03 a	15	-0.02	$\pm$ 0.05 a	10	-0.09	$\pm$ 0.04 a	2	0.09	$\pm$ 0.07 ab	24	0.03	$\pm$ 0.04 a	18	0.02	$\pm$ 0.03 a
March - May	67	0.05	$\pm$ 0.02 a	73	0.01	$\pm$ 0.03 a	70	0.04	$\pm$ 0.02 b	51	-0.08	$\pm$ 0.04 a	27	-0.03	$\pm$ 0.04 a	22	-0.02	$\pm$ 0.03 a
June - September	29	-0.10	$\pm$ 0.03 b	24	0.01	$\pm$ 0.04 a	23	0.05	$\pm$ 0.03 b	40	-0.01	$\pm$ 0.04 b						
Regression on body weight		-0.00	$\pm$ 0.0001		0.0001	$\pm$ 0.0001		0.00	$\pm$ 0.0001		0.0003	$\pm$ 0.0001		-0.0003	$\pm$ 0.0002		0.0003	$\pm$ 0.0001
Afternoon body temperature																		
General mean	121	39.37	$\pm$ 0.03	112	39.33	$\pm$ 0.02	97	39.33	$\pm$ 0.02	87	39.24	$\pm$ 0.04	50	39.37	$\pm$ 0.04	39	39.41	$\pm$ 0.09
Sex:																		
Male	56	0.01	$\pm$ 0.02 a	51	-0.00	$\pm$ 0.02 a	41	-0.03	$\pm$ 0.01 a	38	0.06	$\pm$ 0.03 a	15	-0.09	$\pm$ 0.02 a	10	-0.01	$\pm$ 0.03 a
Female	65	-0.01	$\pm$ 0.02 a	61	0.00	$\pm$ 0.02 a	56	0.03	$\pm$ 0.01 b	49	-0.06	$\pm$ 0.03 a	35	0.09	$\pm$ 0.02 b	29	0.01	$\pm$ 0.03 a
Air temperature																		
< 20 °C.	41	-0.16	$\pm$ 0.07 a	17	-0.05	$\pm$ 0.06 a					-0.10	$\pm$ 0.08 a	15	-0.06	$\pm$ 0.02 a	12	0.01	$\pm$ 0.04 a
20 - 29 °C.	54	0.01	$\pm$ 0.06 b	60	0.03	$\pm$ 0.04 a	63	-0.06	$\pm$ 0.01 a	47	0.10	$\pm$ 0.08 a	35	0.06	$\pm$ 0.02 b	27	-0.01	$\pm$ 0.04 a
$\geq$ 30 °C.	26	0.15	$\pm$ 0.11 a	35	0.06	$\pm$ 0.05 a	34	0.06	$\pm$ 0.01 b	40								
Season:																		
December-February	25	0.03	$\pm$ 0.07 a	15	-0.08	$\pm$ 0.07 a					0.04	$\pm$ 0.08 a	23	0.05	$\pm$ 0.02 a	17	-0.02	$\pm$ 0.03 a
March - May	67	0.04	$\pm$ 0.06 a	73	0.03	$\pm$ 0.04 a	74	0.03	$\pm$ 0.01 a	47	-0.04	$\pm$ 0.08 a	27	-0.05	$\pm$ 0.02 b	22	0.02	$\pm$ 0.03 a
June - September	29	-0.07	$\pm$ 0.11 a	24	0.05	$\pm$ 0.06 a	23	-0.03	$\pm$ 0.01 b	40								
Regression on body weight		-0.0002	$\pm$ 0.0002		0.0001	$\pm$ 0.0002		0.000	$\pm$ 0.0001		0.0006	$\pm$ 0.0002		-0.0001	$\pm$ 0.0001		0.000	$\pm$ 0.0001

Table (9): Least squares constants $\pm$ Standard errors of factors affecting body temperature in offspring of Grey Flanders rabbits.

Classification	Weaning		6 weeks		8 weeks		10 weeks		12 weeks		14 weeks		16 weeks	
	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.
<u>Morning body temperature</u>														
General mean	100	39.18 $\pm$ 0.02	91	39.16 $\pm$ 0.02	77	39.12 $\pm$ 0.01	67	39.19 $\pm$ 0.03	61	39.21 $\pm$ 0.02	38	39.02 $\pm$ 0.02	28	38.88 $\pm$ 0.22
Sex:														
Male	54	0.03 $\pm$ 0.02a	40	-0.05 $\pm$ 0.01a	34	0.01 $\pm$ 0.01a	29	0.00 $\pm$ 0.01a	26	-0.00 $\pm$ 0.00a	11	-0.01 $\pm$ 0.01a	5	0.02 $\pm$ 0.08a
Female	46	-0.03 $\pm$ 0.02a	51	0.05 $\pm$ 0.01b	43	-0.01 $\pm$ 0.01a	38	-0.00 $\pm$ 0.01a	35	0.00 $\pm$ 0.00a	27	0.01 $\pm$ 0.01a	23	-0.02 $\pm$ 0.08a
Air temperature														
< 20°C.	36	-0.03 $\pm$ 0.04a	24	-0.02 $\pm$ 0.04a	23	-0.04 $\pm$ 0.01a	9	0.03 $\pm$ 0.03a	8	0.03 $\pm$ 0.02a	13	-0.04 $\pm$ 0.01a	4	0.02 $\pm$ 0.08a
> 20°C.	64	0.03 $\pm$ 0.04a	67	0.02 $\pm$ 0.04a	54	0.04 $\pm$ 0.01b	58	-0.03 $\pm$ 0.03a	53	-0.03 $\pm$ 0.02a	25	0.04 $\pm$ 0.01b	24	-0.02 $\pm$ 0.08a
Season														
December-February	28	0.03 $\pm$ 0.05a	21	0.08 $\pm$ 0.06a			5	-0.07 $\pm$ 0.04a	5	-0.06 $\pm$ 0.02a			10	0.02 $\pm$ 0.07a
March - May	54	0.00 $\pm$ 0.03a	53	-0.06 $\pm$ 0.03a	55	0.04 $\pm$ 0.01a	18	-0.03 $\pm$ 0.02a	15	-0.02 $\pm$ 0.01a	15	0.02 $\pm$ 0.01a	18	-0.02 $\pm$ 0.07a
June - September	18	-0.03 $\pm$ 0.04a	17	-0.02 $\pm$ 0.04a	22	-0.04 $\pm$ 0.01b	44	0.10 $\pm$ 0.03b	41	0.08 $\pm$ 0.02b	23	-0.02 $\pm$ 0.01b		
Regression on: body weight		0.0001 $\pm$ 0.0003		0.0003 $\pm$ 0.0002		-0.0001 $\pm$ 0.0001		-0.0003 $\pm$ 0.0003		-0.0001 $\pm$ 0.0001		0.0002 $\pm$ 0.0002		0.0006 $\pm$ 0.0003
<u>Afternoon body temperature</u>														
General mean	100	39.31 $\pm$ 0.01	91	39.26 $\pm$ 0.03	65	39.24 $\pm$ 0.08	62	39.29 $\pm$ 0.04	56	39.39 $\pm$ 0.04	34	39.05 $\pm$ 0.22	24	39.58 $\pm$ 0.04
Sex:														
Male	46	-0.01 $\pm$ 0.02a	40	-0.00 $\pm$ 0.02a	27	-0.01 $\pm$ 0.03a	26	-0.02 $\pm$ 0.02a	23	-0.01 $\pm$ 0.01a	9	0.00 $\pm$ 0.05a	3	0.13 $\pm$ 0.02a
Female	54	0.01 $\pm$ 0.02a	51	0.00 $\pm$ 0.02a	38	0.01 $\pm$ 0.03a	36	0.02 $\pm$ 0.02a	33	0.01 $\pm$ 0.01a	25	-0.00 $\pm$ 0.05a	21	-0.13 $\pm$ 0.02b
Air temperature														
< 20°C.	34	-0.10 $\pm$ 0.06a	23	-0.25 $\pm$ 0.10a				-0.03 $\pm$ 0.02a	22	-0.04 $\pm$ 0.02a	10	0.01 $\pm$ 0.05a	5	0.07 $\pm$ 0.01a
> 20°C.	52	0.05 $\pm$ 0.06b	36	0.09 $\pm$ 0.06b	47	0.09 $\pm$ 0.07a	25	0.03 $\pm$ 0.02a	34	0.04 $\pm$ 0.02b	24	-0.01 $\pm$ 0.06a	19	-0.07 $\pm$ 0.01b
> 30°C.	14	0.05 $\pm$ 0.08ab	32	0.16 $\pm$ 0.06b	18	0.09 $\pm$ 0.07a	25	0.03 $\pm$ 0.02a						
Season														
December-February	28	-0.02 $\pm$ 0.06a	21	0.21 $\pm$ 0.11a				-0.07 $\pm$ 0.02a	15	-0.08 $\pm$ 0.02a	11	-0.08 $\pm$ 0.06a	6	-0.12 $\pm$ 0.01a
March - May	54	-0.04 $\pm$ 0.04a	53	-0.08 $\pm$ 0.06a	43	-0.01 $\pm$ 0.06a	18	0.07 $\pm$ 0.02b	41	0.08 $\pm$ 0.02b	23	0.08 $\pm$ 0.06a	18	0.12 $\pm$ 0.01b
June - September	18	0.06 $\pm$ 0.07a	17	-0.13 $\pm$ 0.07a	22	0.01 $\pm$ 0.06a	44	0.07 $\pm$ 0.02b						
Regression on: body weight		0.0000 $\pm$ 0.0003		0.0002 $\pm$ 0.0003		0.0003 $\pm$ 0.0003		0.0000 $\pm$ 0.0002		-0.0002 $\pm$ 0.0001		0.0004 $\pm$ 0.0002		-0.0001 $\pm$ 0.0000

temperature in morning and in afternoon showed that both males and females were nearly of similar body temperature at all comparable ages (Tables 5, 7 and 9). Sex differences were not significant at most ages in all breeds studied (Tables 6, 8 and 10). These results are in agreement with those reported by Abdel-Malek (1967) in Giza White rabbits, who found that body temperature was the same in both sexes.

Air temperature:

The morning air temperature was classified into two levels ($<20^{\circ}\text{C}$ and $20-28^{\circ}\text{C}$), while afternoon air temperature was classified into three levels ($<20^{\circ}\text{C}$, $20-30^{\circ}\text{C}$ and $30-38^{\circ}\text{C}$). Results of the effect of air temperature (in the morning and in the afternoon) on body temperature of rabbits of the three breeds at the different ages studied showed in general a slight positive association between air temperature and body temperature at the time of measurement (Tables 5, 7 and 9). At each time of measurements, difference in body temperature due to air temperature was found to be significant ($P < 0.05$ or < 0.01) at most ages in all the breeds used (Tables 6, 8 and 10).

It is clear that body temperature is slightly increased with raising air temperature either in the morning or in the afternoon. This is because rabbits are homeothermic animals and thus they are always trying to keep their body temperature constant, in spite of fluctuations in environmental temperature by increasing their respiration rate to get rid of the excess

Table (6) : Least squares analysis of variance of factors affecting body temperature in offspring of Cixa White rabbits.

Source of variation	Meaning			5 Weeks			8 Weeks			10 Weeks			14 Weeks			16 Weeks		
	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %
Morning body temperature																		
Sex	1	0.0717	2.63	1	0.0129	0.00	1	0.045	4.35	1	0.0857	7.41	1	0.0356	0.00	1	0.0150	0.00
Air temperature	1	0.0731	2.63	1	0.0744	1.96	1	0.0231	0.00	1	0.0825	11.11	1	0.0071	0.00	1	0.0139	0.00
Season	2	0.2181	15.78	2	0.0060	0.00	2	0.0680	8.70	2	0.0581	7.41	1	0.0491	0.00	1	0.0154	0.00
Regression on body weight	1	0.0010		1	0.0050		1	0.0011		1	0.1825		1	0.2453		1	0.2335	
Residual	115	0.0266	78.96	106	0.0531	98.04	97	0.0193	86.95	87	0.0172	74.07	46	0.0734	100.00	35	0.0363	100.00
Afternoon body temperature																		
Sex	1	0.0221	0.00	1	0.0000	0.00	1	0.0731	5.62	1	0.3021	5.38	1	0.2787	41.67	1	0.0011	0.00
Air temperature	2	0.2441	12.50	2	0.0746	0.83	1	0.1739	32.58	1	0.1354	8.60	1	0.1047	19.44	1	0.0022	0.00
Season	2	0.0155	0.00	2	0.0482	0.00	1	0.0366	5.62	1	0.0192	0.00	1	0.0722	11.11	1	0.0135	0.00
Regression on body weight	1	0.0577		1	0.0455		1	0.0002		1	0.6241		1	0.0060		1	0.0014	
Residual	114	0.0663	87.50	105	0.0637	99.17	92	0.095	56.18	82	0.0831	85.02	45	0.0111	27.78	34	0.0308	100.00

Table (8): Least squares analysis of variance of factors affecting body temperature in offspring of Bauscat rabbits.

Source of variation	Weaning			6 weeks			8 weeks			10 weeks			12 weeks			14 weeks			16 weeks		
	Mean	Variance		Mean	Variance		Mean	Variance		Mean	Variance		Mean	Variance		Mean	Variance		Mean	Variance	
	d.f.	square	%	d.f.	square	%	d.f.	square	%	d.f.	square	%	d.f.	square	%	d.f.	square	%	d.f.	square	%
Morning body temperature																					
Sex	1	0.1021	0.10	1	0.0088	0.00	1	0.0043	0.00	1	0.0024	0.00	1	0.6155	0.41	1	0.0105	3.41	1	0.0067	0.00
Air temperature	1	0.0022	0.00	1	0.4681 ^M	12.50	1	0.4911 ^M	13.79	1	0.0647 ^M	27.97	1	0.0017	0.00	1	0.0023	0.00	1	0.1614 ^M	24.07
Season	2	0.3895 ^M	7.11	2	0.0042	0.00	1	0.0127	0.00	2	0.0164	2.10	2	0.2674	0.00	1	0.0482 ^M	22.87	1	0.3957 ^M	20.37
Regression on body weight	1	0.0441		1	0.0420		1	0.1196		1	0.0168		1	0.1396		1	0.0009		1	0.0716	
Residual	188	0.0908	92.79	180	0.0733	87.50	173	0.0495	86.21	151	0.0149	69.93	135	0.4907	99.59	82	0.0038	73.72	73	0.0317	55.56
Afternoon body temperature																					
Sex	1	0.7594	0.24	1	0.1161	0.89	1	0.1586	1.12	1	0.0830	1.48	1	0.0182	0.00	1	0.0092	0.00	1	0.0080	0.00
Air temperature	2	2.8242 ^M	7.97	2	0.3251 ^M	41.07	1	0.0961	0.45	1	0.0029	0.00	1	0.0484	1.47	1	0.0172	7.41	1	0.1779 ^M	50.00
Season	2	0.0604	0.00	2	0.1399	4.47	1	0.5721 ^M	8.84	1	0.0000	0.00	1	0.0733	25.00	1	0.0001	0.00	1	0.0589 ^M	16.67
Regression on body weight	1	0.2627		1	0.0865		1	0.0305		1	0.0022		1	0.1538 ^M		1	0.0013		1	0.0000	
Residual	187	0.6086	91.79	179	0.0618	53.57	152	0.0748	78.39	138	0.0584	98.52	128	0.0210	73.53	43	0.0087	92.59	57	0.0121	33.33

Table (10): Least squares analysis of variance of factors affecting body temperature in offspring of Gray Flander rabbits.

Source of variance	Weaning				6 weeks				8 weeks				10 weeks				12 weeks				14 weeks				16 weeks				
	Mean d.f	Variance square	%		Mean d.f	Variance square	%		Mean d.f	Variance square	%		Mean d.f	Variance square	%		Mean d.f	Variance square	%		Mean d.f	Variance square	%		Mean d.f	Variance square	%		
<u>Morning body temperature</u>																													
Sex	1	0.0872	2.44	1	0.2210 ^{xx}	19.23	1	0.0106	0.00	1	0.0013	0.00	1	0.0000	0.00	1	0.0038	4.61	1	0.0027	0.00								
Air temperature	1	0.0176	0.00	1	0.0031	0.00	1	0.0881 ^{xx}	23.53	1	0.0125	0.00	1	0.0066	25.00	1	0.0218 ^{xx}	54.89	1	0.0033	0.00								
Season	2	0.0122	0.00	2	0.0375	3.65	1	0.0798 ^{xx}	17.65	2	0.0816 ^{xx}	37.50	2	0.0439 ^{xx}	50.00	1	0.0077 ^{xx}	16.17	1	0.0056	0.00								
Regression on body weight	1	0.0056		1	0.0468		1	0.0021		1	0.0507 ^{xx}		1	0.0186 ^{xx}		1	0.0555 ^{xx}		1	0.2232									
Residual	94	0.0352	97.56	85	0.0169	76.92	72	0.0087	58.82	61	0.0082	62.50	55	0.0023	25.00	33	0.0011	24.33	23	0.0564	100.0								
<u>Afternoon body temperature</u>																													
Sex	1	0.0145	0.00	1	0.0033	0.00	1	0.0079	0.00	1	0.0306	0.97	1	0.0016	0.00	1	0.0002	0.00	1	0.1085 ^{xx}	49.65								
Air temperature	2	0.0909	9.09	2	0.1570 ^{xx}	18.52	1	0.1028	9.09	1	0.0494	4.53	1	0.0412 ^{xx}	9.10	1	0.0019	0.00	1	0.0387 ^{xx}	11.38								
Season	2	0.0201	0.00	2	0.0815	7.41	1	0.0031	0.00	1	0.1657 ^{xx}	29.77	1	0.1193 ^{xx}	45.45	1	0.1040	12.28	1	0.0941 ^{xx}	37.03								
Regression on body weight	2	0.0012		1	0.0118		1	0.0583		1	0.0004		1	0.0279		1	0.1221		1	0.0096 ^{xx}									
Residual	93	0.0403	90.91	84	0.0409	74.07	60	0.0604	90.91	57	0.0154	64.73	51	0.0098	45.45	29	0.0474	87.72	19	0.0014	1.94								

in body temperature.

In agreement with the present results, Johnson et al. (1957 & 1958) in NewZealand White rabbits and Hassanein (1980) in Giza White rabbits, reported that body temperature was increased within the sub-lethal temperature with raising air temperature.

Season:

Body temperature of the offspring of the three breeds at different ages from weaning to 16 weeks of age varied slightly with season of the year but did not show any consistent trend (Tables 5,7 and 9). Seasonal differences in body temperature of animals of each breed either in the morning or in the afternoon were found to be significant ($P \leq 0.05$ or $P \leq 0.01$) at some ages and non-significant at others (Tables 6,8 and 10). Body temperature of the offspring is expected to be higher in summer months than in winter months because of the higher air temperature in summer than in winter, but this was not realized at all ages studied.

Changes in body temperature of the offspring of this work caused by seasonal variation were observed to be small (Tables 5,7 and 9). Similar results were reported by Johnson et al. (1958) on NewZealand White rabbits, Abdel-Malek (1967) and Shafie et al. (1970) on Giza White

rabbits. Shafie et al. (1970) attributed the slight seasonal variation to that body temperature in rabbits is regulated by other physiological reactions which act to keep body temperature constant.

Body weight:

The effect of body weight on body temperature was studied in the form of linear regression (Tables 5, 7 and 9). Most values of the regression coefficients of body temperature on body weight at different ages in all breeds were either of very small negative magnitude or equal zero. Thus, body weight of the rabbit did not show any obvious effect on body temperature.

2. Respiration rate

The respiratory system in homeothermic animals is one of the most important systems by which the animal regulates the internal body temperature and induces its stability inspite of the fluctuations in the environmental temperature. Thus, the animal, through respiratory system, is able to change the rate of both heat production and dissipation at the same time. This is to maintain body temperature at a fairly stable value by increasing or decreasing water vaporization. Respiration rate, therefore, may be affected by body temperature and air temperature; beside some other physiological processes and surrounding environmental influences.

a) Respiration Rate in Does

Results presented in Table (11) show that the overall means of respiration rate in the morning were 143.2, 150.6 and 140.3 per minute in Giza White, Bauscat and Grey Flander does, respectively. The respective afternoon values were 150.9, 149.9 and 149.0 per minute. The afternoon records seem to be slightly higher than those of the morning. This may be attributed to the lower morning air temperatures than those of the afternoon (Table 2).

Table (11). Least squares constants $\pm$ standard errors of factors affecting respiration rate in does.

Classification	N	Gisa White				Bauscat				Grey Flender			
		Morning		Afternoon		Morning		Afternoon		Morning		Afternoon	
		Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.	Const. $\pm$ S.E.
General mean	290	143.2 $\pm$ 1.0	150.9 $\pm$ 1.0	150.9 $\pm$ 1.0	150.9 $\pm$ 1.0	150.6 $\pm$ 2.3	149.9 $\pm$ 0.8	149.9 $\pm$ 0.8	149.9 $\pm$ 0.8	140.3 $\pm$ 1.0	149.0 $\pm$ 1.0	149.0 $\pm$ 1.0	149.0 $\pm$ 1.0
Month:													
October (21.7°C.)	35	-8.4 $\pm$ 2.0 a	-9.1 $\pm$ 2.0 a	-9.1 $\pm$ 2.0 a	-9.1 $\pm$ 2.0 a	-23.1 $\pm$ 4.1 a	-15.5 $\pm$ 1.4 a	-15.5 $\pm$ 1.4 a	-15.5 $\pm$ 1.4 a	-6.6 $\pm$ 2.2 a	-4.8 $\pm$ 2.2 a	-4.8 $\pm$ 2.2 a	-4.8 $\pm$ 2.2 a
November (19.5°C.)	30	-15.8 $\pm$ 2.0 bd	-19.9 $\pm$ 2.0 bd	-19.9 $\pm$ 2.0 bd	-19.9 $\pm$ 2.0 bd	-30.9 $\pm$ 4.0 ab	-28.7 $\pm$ 1.4 b	-28.7 $\pm$ 1.4 b	-28.7 $\pm$ 1.4 b	-18.3 $\pm$ 2.1 bd	-24.0 $\pm$ 2.2 bc	-24.0 $\pm$ 2.2 bc	-24.0 $\pm$ 2.2 bc
December (14.6°C.)	26	-33.8 $\pm$ 2.1 c	-32.4 $\pm$ 2.0 c	-32.4 $\pm$ 2.0 c	-32.4 $\pm$ 2.0 c	-38.4 $\pm$ 4.2 b	-35.9 $\pm$ 1.4 c	-35.9 $\pm$ 1.4 c	-35.9 $\pm$ 1.4 c	-31.1 $\pm$ 2.2 c	-30.3 $\pm$ 2.3 c	-30.3 $\pm$ 2.3 c	-30.3 $\pm$ 2.3 c
January (12.5°C.)	26	-21.2 $\pm$ 2.1 d	-20.6 $\pm$ 2.1 b	-20.6 $\pm$ 2.1 b	-20.6 $\pm$ 2.1 b	-32.1 $\pm$ 4.3 ab	-24.0 $\pm$ 1.5 d	-24.0 $\pm$ 1.5 d	-24.0 $\pm$ 1.5 d	-18.9 $\pm$ 2.1 d	-25.2 $\pm$ 2.2 c	-25.2 $\pm$ 2.2 c	-25.2 $\pm$ 2.2 c
February (15.1°C.)	26	-12.6 $\pm$ 2.1 ab	-14.0 $\pm$ 2.0 ad	-14.0 $\pm$ 2.0 ad	-14.0 $\pm$ 2.0 ad	-23.0 $\pm$ 4.1 a	-15.5 $\pm$ 1.4 a	-15.5 $\pm$ 1.4 a	-15.5 $\pm$ 1.4 a	-8.5 $\pm$ 2.1 a	-9.8 $\pm$ 2.2 d	-9.8 $\pm$ 2.2 d	-9.8 $\pm$ 2.2 d
March (20.2°C.)	26	-1.8 $\pm$ 2.1 e	-1.1 $\pm$ 2.0 e	-1.1 $\pm$ 2.0 e	-1.1 $\pm$ 2.0 e	-2.1 $\pm$ 4.1 c	1.6 $\pm$ 1.4 e	1.6 $\pm$ 1.4 e	1.6 $\pm$ 1.4 e	-6.0 $\pm$ 2.3 a	-3.2 $\pm$ 2.3 a	-3.2 $\pm$ 2.3 a	-3.2 $\pm$ 2.3 a
April (24.5°C.)	30	8.0 $\pm$ 2.0 f	7.0 $\pm$ 1.9 f	7.0 $\pm$ 1.9 f	7.0 $\pm$ 1.9 f	9.3 $\pm$ 4.0 cd	11.4 $\pm$ 1.4 f	11.4 $\pm$ 1.4 f	11.4 $\pm$ 1.4 f	11.5 $\pm$ 2.2 e	11.3 $\pm$ 2.3 e	11.3 $\pm$ 2.3 e	11.3 $\pm$ 2.3 e
May (26.9°C.)	31	15.1 $\pm$ 2.0 g	15.0 $\pm$ 1.9 g	15.0 $\pm$ 1.9 g	15.0 $\pm$ 1.9 g	18.2 $\pm$ 4.0 de	19.9 $\pm$ 1.3 g	19.9 $\pm$ 1.3 g	19.9 $\pm$ 1.3 g	14.3 $\pm$ 2.1 eg	16.7 $\pm$ 2.2 eg	16.7 $\pm$ 2.2 eg	16.7 $\pm$ 2.2 eg
June (29.9°C.)	24	22.5 $\pm$ 2.2 h	24.2 $\pm$ 2.1 h	24.2 $\pm$ 2.1 h	24.2 $\pm$ 2.1 h	25.1 $\pm$ 4.4 e	27.6 $\pm$ 1.5 h	27.6 $\pm$ 1.5 h	27.6 $\pm$ 1.5 h	18.3 $\pm$ 2.4 gh	23.4 $\pm$ 2.5 gh	23.4 $\pm$ 2.5 gh	23.4 $\pm$ 2.5 gh
July (28.8°C.)	24	22.1 $\pm$ 2.2 h	24.1 $\pm$ 2.1 h	24.1 $\pm$ 2.1 h	24.1 $\pm$ 2.1 h	28.5 $\pm$ 4.8 e	28.8 $\pm$ 1.6 h	28.8 $\pm$ 1.6 h	28.8 $\pm$ 1.6 h	22.2 $\pm$ 2.4 h	24.3 $\pm$ 2.4 h	24.3 $\pm$ 2.4 h	24.3 $\pm$ 2.4 h
August (29.5°C.)	12	25.9 $\pm$ 3.1 h	26.8 $\pm$ 2.9 h	26.8 $\pm$ 2.9 h	26.8 $\pm$ 2.9 h	68.5 $\pm$ 6.6 f	30.3 $\pm$ 2.3 h	30.3 $\pm$ 2.3 h	30.3 $\pm$ 2.3 h	23.1 $\pm$ 3.5 gh	21.7 $\pm$ 3.6 gh	21.7 $\pm$ 3.6 gh	21.7 $\pm$ 3.6 gh
Weight of doe													
< 2500 grams	139	-0.2 $\pm$ 0.8 a	-0.5 $\pm$ 0.7 a	-0.5 $\pm$ 0.7 a	-0.5 $\pm$ 0.7 a	1.7 $\pm$ 1.5 a	-0.2 $\pm$ 0.5 a	-0.2 $\pm$ 0.5 a	-0.2 $\pm$ 0.5 a	0.1 $\pm$ 0.8 a	0.5 $\pm$ 0.8 a	0.5 $\pm$ 0.8 a	0.5 $\pm$ 0.8 a
> 2500 grams	151	0.2 $\pm$ 0.8 a	0.5 $\pm$ 0.7 a	0.5 $\pm$ 0.7 a	0.5 $\pm$ 0.7 a	-1.7 $\pm$ 1.5 a	0.2 $\pm$ 0.5 a	0.2 $\pm$ 0.5 a	0.2 $\pm$ 0.5 a	-0.1 $\pm$ 0.8 a	-0.5 $\pm$ 0.8 a	-0.5 $\pm$ 0.8 a	-0.5 $\pm$ 0.8 a
Age of doe:													
0 - 12 months	84	0.3 $\pm$ 1.3 ab	0.0 $\pm$ 1.3 a	0.0 $\pm$ 1.3 a	0.0 $\pm$ 1.3 a	10.6 $\pm$ 2.6 a	3.6 $\pm$ 0.9 a	3.6 $\pm$ 0.9 a	3.6 $\pm$ 0.9 a	-0.2 $\pm$ 1.5 a	0.1 $\pm$ 1.5 a	0.1 $\pm$ 1.5 a	0.1 $\pm$ 1.5 a
> 12 - 24 months	128	-2.0 $\pm$ 1.0 a	-1.5 $\pm$ 0.9 a	-1.5 $\pm$ 0.9 a	-1.5 $\pm$ 0.9 a	-6.2 $\pm$ 2.0 bc	-0.4 $\pm$ 0.7 b	-0.4 $\pm$ 0.7 b	-0.4 $\pm$ 0.7 b	0.5 $\pm$ 1.2 a	0.4 $\pm$ 1.2 a	0.4 $\pm$ 1.2 a	0.4 $\pm$ 1.2 a
> 24 months	78	1.7 $\pm$ 1.1 b	1.5 $\pm$ 0.9 a	1.5 $\pm$ 0.9 a	1.5 $\pm$ 0.9 a	-4.4 $\pm$ 2.2 c	-3.2 $\pm$ 0.7 c	-3.2 $\pm$ 0.7 c	-3.2 $\pm$ 0.7 c	-0.3 $\pm$ 1.0 a	-0.5 $\pm$ 1.0 a	-0.5 $\pm$ 1.0 a	-0.5 $\pm$ 1.0 a
Reproductive status:													
Pregnancy	89	0.8 $\pm$ 0.9 a	1.1 $\pm$ 0.9 a	1.1 $\pm$ 0.9 a	1.1 $\pm$ 0.9 a	2.2 $\pm$ 1.8 a	-0.3 $\pm$ 0.6 a	-0.3 $\pm$ 0.6 a	-0.3 $\pm$ 0.6 a	2.4 $\pm$ 0.9 a	1.2 $\pm$ 0.9 a	1.2 $\pm$ 0.9 a	1.2 $\pm$ 0.9 a
No pregnancy	201	-0.8 $\pm$ 0.9 a	-1.1 $\pm$ 0.9 a	-1.1 $\pm$ 0.9 a	-1.1 $\pm$ 0.9 a	-2.2 $\pm$ 1.8 a	0.3 $\pm$ 0.6 a	0.3 $\pm$ 0.6 a	0.3 $\pm$ 0.6 a	-2.4 $\pm$ 0.9 b	-1.2 $\pm$ 0.9 a	-1.2 $\pm$ 0.9 a	-1.2 $\pm$ 0.9 a
Suckling status:													
Suckling	76	0.9 $\pm$ 1.0 a	1.1 $\pm$ 0.9 a	1.1 $\pm$ 0.9 a	1.1 $\pm$ 0.9 a	4.7 $\pm$ 1.8 a	-0.4 $\pm$ 0.6 a	-0.4 $\pm$ 0.6 a	-0.4 $\pm$ 0.6 a	-0.7 $\pm$ 0.8 a	-0.9 $\pm$ 0.9 a	-0.9 $\pm$ 0.9 a	-0.9 $\pm$ 0.9 a
No suckling	214	-0.9 $\pm$ 1.0 a	-1.1 $\pm$ 0.9 a	-1.1 $\pm$ 0.9 a	-1.1 $\pm$ 0.9 a	-4.7 $\pm$ 1.8 b	0.4 $\pm$ 0.6 a	0.4 $\pm$ 0.6 a	0.4 $\pm$ 0.6 a	0.7 $\pm$ 0.8 a	0.9 $\pm$ 0.9 a	0.9 $\pm$ 0.9 a	0.9 $\pm$ 0.9 a

Month:

Respiration rate in the morning and in the afternoon varied significantly ($P < 0.01$) with months of the year (Tables 11 and 12). Respiration rate in the morning and in the afternoon, respectively, averaged 166.9 and 170.8 per minute during summer months (April-September) and 126.2 and 132.6 per minute during winter months (October-March). These information indicate that respiration rate during summer months exceeded respiration rate during winter months by 40.7 per minute in the morning and 38.2 per minute in the afternoon. Seasonal variation in respiration rate may be attributed to seasonal differences in both air and body temperatures, the average air and body temperatures, respectively, were 27.89 and 39.64°C. in summer and 17.06 and 39.03°C in winter.

Johnson et al. (1958) in New Zealand White rabbits, Abdel-Malek (1967) and Shafie et al. (1970) in Giza White rabbits found that respiration rate was greatly affected by monthly changes in air temperature and the maximum values of respiration rate were observed during summer months (June-August). These results appear to be in agreement with those obtained in this work.

Body weight:

Results presented in Table 11 and 12 show that,

Table (12) : Least squares analysis of variance of factors affecting respiration rate in does.

Source of Variation	Giza White						Bauscat						Grey Flander					
	Morning			Afternoon			Morning			Afternoon			Morning			Afternoon		
	Mean square			Mean square			Mean square			Mean square			Mean square			Mean square		
	d.f	Variance %		d.f	Variance %		d.f	Variance %		d.f	Variance %		d.f	Variance %		d.f	Variance %	
Month	10	6926.10	70.43	7309.80	73.06	10	24099.86	43.43	16416.11	82.03	10	4647.89	70.90	5909.90	76.58	10	4647.89	70.90
Weight of doe	1	6.98	0.00	50.90	0.00	1	938.58	0.08	10.03	0.00	1	2.84	0.00	38.61	0.00	1	2.84	0.00
Age of doe	2	319.89	0.77	193.48	0.32	2	6555.65	3.79	965.46	1.60	2	11.10	0.00	15.80	0.00	2	11.10	0.00
Reproductive status	1	82.26	0.00	179.44	0.24	1	1145.70	0.24	23.25	0.00	1	712.89	2.79	161.85	0.24	1	712.89	2.79
Suckling status	1	103.90	0.00	155.77	0.19	1	4835.50	2.51	34.37	0.00	1	56.93	0.00	99.28	0.00	1	56.93	0.00
Residual	274	115.71	28.80	107.31	26.19	434	735.79	49.95	86.56	16.37	195	96.33	26.31	100.30	23.18	195	96.33	26.31

for the three breeds of the study, weight of doe did not exhibit any significant effect on its respiration rate either in the morning or in the afternoon. But, when considering does of all these breeds together, respiration rate for does of ≤ 2500 grams weight was nearly the same as that for does of > 2500 grams weight in the morning (145.2 and 144.2 per minute, respectively) and in the afternoon (149.9 and 150.0 per minute, respectively). All these observations show that the effect of doe's weight was a negligible source of variation in its respiration rate.

Age of doe:

Respiration rate of the doe in the morning and in the afternoon tended to decreased slightly with advance in age. The averages of respiration rate for does of 8-12, $> 12-24$, and > 24 months old, respectively, were 148.3, 142.1 and 143.7 per minute in the morning and 151.2, 149.4 and 149.0 per minute in the afternoon (Table 11). Differences in respiration rate in the morning and in the afternoon due to age of doe were highly significant ($P < 0.01$) in Bauscat does and non-significant in both Giza White and Grey Flander does (Table 12). Results of this study on Bauscat does are in line with those reported on Giza White rabbits by Abdel-Malek (1967) and Hassanein (1980) who showed that

the effect of age on respiration rate was highly significant ($P < 0.01$). The latter author stated that the increase in respiration rate in young does may be attributed to irritability and restlessness with the experience of pregnancy.

Reproductive status:

Respiration rates of pregnant does were 146.5 and 150.6 per minute in the morning and in the afternoon, respectively. The respective values of non-pregnant ones were 142.9 and 149.3 per minute (Table 11). The statistical analysis showed that reproductive status had no significant effect on respiration rate of does of all breeds except for Grey Flander in the morning (Table 12). Previous studies of Abdel-Malek (1967) and Hassanein (1980) on Giza White rabbits showed, however, higher respiration rate for non-pregnant does than for pregnant ones, the differences being highly significant ($P < 0.01$). This seems to be in disagreement with the present results in general.

Suckling status:

Respiration rate of suckling does of all breeds averaged 146.2 and 150.0 per minute in the morning and in the afternoon, respectively. The respective values were 143.1 and 150.0 per minute for the non-suckling

does (Table 11). Coupling those findings with these of the analysis of variance presented in Table 12, it could be noted that the differences in respiration rate between suckling and non-suckling does were either very limited or null and in most cases they were non-significant. Similar results were obtained by Hassanein (1980) who reported that suckling status had no significant effect on respiration rate.

b) Respiration Rate in Offspring

The overall means of respiration rate in the morning and in the afternoon calculated for the offspring of Giza White, Bauscat and Grey Flander rabbits at different ages are presented in Tables 13, 15 and 17, respectively. These means showed that no considerable differences was detected between breeds in either morning or afternoon offspring respiration rate at any of the different ages studied. Also, results of the same tables, did not show any consistent trend for the change in respiration rate with age changes.

The averages of the means of respiration rate at all ages of Giza White, Bauscat and Grey Flander offspring, respectively, were 164.8, 163.6 and 163.0 per minute in the morning; and 187.6, 188.8 and 183.0 per minute in the afternoon. These averages reveal that the afternoon respiration rate was higher than the morning respiration rate by 23, 25 and 20 per minute in Giza White, Bauscat and Grey Flander rabbits, respectively. The same trend was observed when considering doe's respiration rate. This trend may be attributed to the higher afternoon air temperature than those of morning (Table 2).

Sex:

Constants of sex effects give evidence that both

Table (13): Least squares constants $\pm$ Standard errors of factors affecting respiration rate in offspring of Gina White rabbits.

Classification	Weaning		6 weeks		8 weeks		10 weeks		14 weeks		16 weeks	
	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.
<u>Morning respiration rate</u>												
<u>General mean</u>	121	167.9 $\pm$ 1.2	112	162.0 $\pm$ 1.5	103	166.9 $\pm$ 2.8	93	160.7 $\pm$ 2.8	51	172.3 $\pm$ 3.1	40	158.8 $\pm$ 5.1
<u>Sex:</u>												
Male	56	0.6 $\pm$ 0.8a	51	-0.9 $\pm$ 1.3a	45	0.3 $\pm$ 1.4a	42	0.2 $\pm$ 1.1a	16	-0.5 $\pm$ 1.0a	11	0.4 $\pm$ 1.5a
Female	65	-0.6 $\pm$ 0.8a	61	0.9 $\pm$ 1.3a	58	-0.3 $\pm$ 1.4a	51	-0.2 $\pm$ 1.1a	35	0.5 $\pm$ 1.0a	29	-0.4 $\pm$ 1.5a
<u>Air temperature</u>												
$\angle 20^{\circ}\text{C.}$	48	-14.0 $\pm$ 1.1a	19	-8.5 $\pm$ 2.1a	14	-6.4 $\pm$ 2.4a	14	-3.1 $\pm$ 1.7a	3	-7.9 $\pm$ 2.0a	1	-14.7 $\pm$ 4.2a
$\geq 20^{\circ}\text{C.}$	73	14.0 $\pm$ 1.1b	93	8.5 $\pm$ 2.1b	89	6.4 $\pm$ 2.4b	79	3.1 $\pm$ 1.7a	48	7.9 $\pm$ 2.0b	39	14.7 $\pm$ 4.2b
<u>Season</u>												
December-February	25	-0.5 $\pm$ 1.8a	15	-8.2 $\pm$ 3.1a	10	-11.8 $\pm$ 3.7a	2	-14.7 $\pm$ 5.3a	24	-0.6 $\pm$ 0.9a	18	-2.4 $\pm$ 1.3a
March - May	67	-0.4 $\pm$ 1.1a	73	-1.0 $\pm$ 2.0a	70	4.3 $\pm$ 2.2a	51	-1.0 $\pm$ 2.8a	27	0.6 $\pm$ 0.9a	22	2.4 $\pm$ 1.3a
June - September	29	0.9 $\pm$ 1.5a	24	9.2 $\pm$ 2.4b	23	16.1 $\pm$ 3.0b	40	15.7 $\pm$ 3.1b				
<u>Regression on body weight</u>												
		-0.0185 $\pm$ 0.0078		-0.0026 $\pm$ 0.0085		-0.0052 $\pm$ 0.0117		0.0045 $\pm$ 0.0071		-0.0058 $\pm$ 0.0044		0.0045 $\pm$ 0.0049
<u>Afternoon respiration rate</u>												
<u>General mean</u>	121	188.5 $\pm$ 2.6	112	177.3 $\pm$ 2.0	97	196.3 $\pm$ 3.7	87	185.5 $\pm$ 2.5	50	197.2 $\pm$ 4.4	39	180.6 $\pm$ 10.1
<u>Sex:</u>												
Male	56	-1.4 $\pm$ 1.7a	51	-2.8 $\pm$ 2.0a	41	2.4 $\pm$ 2.2a	38	0.7 $\pm$ 1.9a	15	0.7 $\pm$ 1.7a	10	3.2 $\pm$ 3.9a
Female	65	1.4 $\pm$ 1.7a	61	2.8 $\pm$ 2.0a	56	-2.4 $\pm$ 2.2a	49	-0.7 $\pm$ 1.7a	35	-0.7 $\pm$ 1.7a	29	-3.2 $\pm$ 3.9a
<u>Air temperature</u>												
$\angle 20^{\circ}\text{C.}$	41	-43.0 $\pm$ 5.1a	17	-18.0 $\pm$ 5.0a								
$20-29.9^{\circ}\text{C.}$	54	-0.9 $\pm$ 4.5b	60	-2.9 $\pm$ 3.2b	63	-10.7 $\pm$ 2.9a	47	-2.9 $\pm$ 4.6a	15	0.9 $\pm$ 2.1a	12	-2.7 $\pm$ 4.2a
$\geq 30^{\circ}\text{C.}$	26	43.9 $\pm$ 8.1a	35	20.9 $\pm$ 4.4a	34	10.7 $\pm$ 2.9b	40	2.9 $\pm$ 4.6a	35	-0.9 $\pm$ 2.1a	27	2.7 $\pm$ 4.2a
<u>Season</u>												
December-February	25	11.4 $\pm$ 5.2a	15	-5.9 $\pm$ 5.4a								
March - May	67	13.5 $\pm$ 4.5a	23	4.1 $\pm$ 3.3a	74	-12.4 $\pm$ 3.3a	47	-14.5 $\pm$ 4.6a	23	-4.3 $\pm$ 1.8a	17	-5.7 $\pm$ 3.9a
June - September	29	-24.9 $\pm$ 7.9b	24	1.8 $\pm$ 5.0a	23	12.4 $\pm$ 3.3b	40	14.5 $\pm$ 4.6b	27	4.3 $\pm$ 1.8b	22	5.7 $\pm$ 3.9a
<u>Regression on: body weight</u>												
		-0.0531 $\pm$ 0.0181		0.0046 $\pm$ 0.0124		0.0193 $\pm$ 0.0174		0.0147 $\pm$ 0.0122		-0.0063 $\pm$ 0.0078		0.0190 $\pm$ 0.0129

Table (15): Least squares constants $\pm$ standard errors of factors affecting respiration rate in offspring of Baucsat rabbits.

Classification	Weaning		6 weeks		8 weeks		10 weeks		12 weeks		14 weeks		16 weeks	
	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.	N	Const. $\pm$ S.E.
<u>Morning Respiration rate</u>														
General mean	194	162.9 $\pm$ 1.9	186	163.9 $\pm$ 4.9	178	160.8 $\pm$ 3.0	157	162.8 $\pm$ 1.2	141	162.2 $\pm$ 2.0	87	167.6 $\pm$ 1.0	78	165.3 $\pm$ 2.5
Sex:														
Male	94	-0.4 $\pm$ 0.6 a	92	1.2 $\pm$ 1.5 a	88	0.1 $\pm$ 0.9 a	75	-0.2 $\pm$ 0.8 a	66	-0.0 $\pm$ 1.2 a	29	0.4 $\pm$ 1.1 a	23	-1.1 $\pm$ 1.1 a
Female	100	0.4 $\pm$ 0.6 a	94	-1.2 $\pm$ 1.5 a	90	-0.1 $\pm$ 0.9 a	82	0.2 $\pm$ 0.8 a	75	0.0 $\pm$ 1.2 a	58	-0.4 $\pm$ 1.1 a	55	1.3 $\pm$ 1.1 a
Air temperature														
< 20°C.	89	-9.5 $\pm$ 0.8 a	41	-11.7 $\pm$ 2.5 a	72	-10.8 $\pm$ 1.1 a	22	-5.8 $\pm$ 1.7 a	16	-6.1 $\pm$ 2.7 a	11	-8.3 $\pm$ 1.7 a	6	-10.1 $\pm$ 1.9 a
$\geq$ 20°C.	105	9.5 $\pm$ 0.8 b	145	11.7 $\pm$ 2.5 b	106	10.8 $\pm$ 1.1 b	135	5.8 $\pm$ 1.7 b	125	6.1 $\pm$ 2.7 b	76	8.3 $\pm$ 1.7 b	72	10.1 $\pm$ 1.9 b
Season														
December-February	46	-8.5 $\pm$ 1.1 a	23	-1.5 $\pm$ 4.5ab			14	-9.8 $\pm$ 2.8 a	8	-15.8 $\pm$ 4.7 a				
March-May	117	-1.0 $\pm$ 0.8 b	134	-4.8 $\pm$ 2.5a	115	-3.7 $\pm$ 1.2 a	76	-3.7 $\pm$ 1.5 a	66	-2.3 $\pm$ 2.5 a	46	-3.9 $\pm$ 1.4 a	39	0.5 $\pm$ 1.1 a
June-September	31	9.5 $\pm$ 1.4 c	29	6.3 $\pm$ 3.5b	63	3.7 $\pm$ 1.2 b	67	13.5 $\pm$ 1.7 b	67	18.1 $\pm$ 2.6 b	41	3.9 $\pm$ 1.4 b	39	-0.5 $\pm$ 1.1 a
Regression on body weight		-0.0141 $\pm$ 0.0062		-0.0031 $\pm$ 0.0146		-0.0166 $\pm$ 0.0077		0.0019 $\pm$ 0.0054		-0.0078 $\pm$ 0.0071		0.0035 $\pm$ 0.0058		0.0008 $\pm$ 0.0053
<u>Afternoon Respiration rate</u>														
General mean	194	179.0 $\pm$ 3.5	186	185.0 $\pm$ 8.6	157	193.0 $\pm$ 6.8	143	190.1 $\pm$ 3.1	133	194.4 $\pm$ 5.4	78	188.0 $\pm$ 2.8	72	192.2 $\pm$ 4.8
Sex:														
Male	94	0.1 $\pm$ 1.1 a	92	-0.2 $\pm$ 1.8 a	83	-1.6 $\pm$ 1.9 a	72	-2.0 $\pm$ 1.4 a	63	0.8 $\pm$ 2.2 a	24	2.8 $\pm$ 2.2 a	21	0.4 $\pm$ 2.2 a
Female	100	-0.1 $\pm$ 1.1 a	94	0.2 $\pm$ 1.8 a	74	1.6 $\pm$ 1.9 a	71	2.0 $\pm$ 1.4 a	70	-0.8 $\pm$ 2.2 a	54	-2.8 $\pm$ 2.2 a	51	-0.4 $\pm$ 2.2 a
Air temperature														
< 20° C.	80	-12.5 $\pm$ 2.6 a	36	-32.6 $\pm$ 5.2 a										
20 - 29.9°C.	95	18.4 $\pm$ 2.1 b	111	-4.8 $\pm$ 3.7 b	122	-5.4 $\pm$ 2.4 a	76	-18.7 $\pm$ 16.9 a	70	-5.8 $\pm$ 6.6 a	16	-6.7 $\pm$ 3.0 a	28	2.6 $\pm$ 3.5 a
$\geq$ 30 °C.	19	-5.9 $\pm$ 3.9 a	39	37.4 $\pm$ 5.4 c	35	5.4 $\pm$ 2.4 b	67	18.7 $\pm$ 16.9 a	63	5.8 $\pm$ 6.6 a	62	6.7 $\pm$ 3.0 b	44	-2.6 $\pm$ 3.5 a
Season														
December-February	46	-20.5 $\pm$ 2.5 a	23	2.2 $\pm$ 6.3 a										
March - May	117	-5.6 $\pm$ 1.9 b	134	2.5 $\pm$ 4.1 a	94	-17.0 $\pm$ 2.1 a	76	-0.0 $\pm$ 16.8 a	66	-14.2 $\pm$ 6.6 a	37	-2.5 $\pm$ 2.4 a	33	-0.5 $\pm$ 3.5 a
June - September	31	26.1 $\pm$ 3.1 c	29	-4.7 $\pm$ 6.3 a	63	17.0 $\pm$ 2.1 b	67	0.0 $\pm$ 16.8 a	67	14.2 $\pm$ 6.6 b	41	2.5 $\pm$ 2.4 a	39	0.5 $\pm$ 3.5 a
Regression on body weight		-0.0129 $\pm$ 0.0114		-0.0023 $\pm$ 0.0177		-0.0125 $\pm$ 0.0182		-0.0078 $\pm$ 0.0108		-0.0222 $\pm$ 0.0138		0.0147 $\pm$ 0.0116		0.0051 $\pm$ 0.0113

Table (1.7): Least squares constants + standard errors of factors affecting respiration rate in offspring of Grey Flander rabbits.

Classification	PEATING		6 WEEKS		8 WEEKS		10 WEEKS		12 WEEKS		14 WEEKS		16 WEEKS	
	N	Const. + S.E.	N	Const. + S.E.	N	Const. + S.E.	N	Const. + S.E.	N	Const. + S.E.	N	Const. + S.E.	N	Const. + S.E.
Morning respiration rate														
General mean	100	164.1±0.7	91	160.5±1.5	77	163.0±1.0	67	157.1±2.9	61	167.5±4.2	30	173.1±5.4	28	155.5±5.5
Sex:														
Male	54	0.5±0.7 a	40	-1.3±1.0 a	34	0.2±0.9 a	29	0.9±1.2 a	25	0.6±1.5 a	11	1.9±1.6 a	5	0.3±1.9 a
Female	46	-0.5±0.7 a	51	1.3±1.0 a	43	-0.2±0.9 a	38	-0.9±1.2 a	35	-0.6±1.5 a	27	-1.9±1.6 a	23	-0.3±1.9 a
Air temperature:														
< 20° C.	36	-10.8±1.4 a	24	-12.6±2.8 a	23	-12.3±1.2 a	9	0.8±2.6 a	8	-6.8±1.7 a	13	-8.3±2.0 a	4	-14.3±1.9 a
≥ 20° C.	64	10.8±1.4 b	67	12.6±2.8 b	54	12.3±1.2 b	58	-0.8±2.6 a	53	6.8±3.7 a	25	8.3±2.0 b	24	14.3±1.9 b
Season:														
December-February	28	-1.2±2.0 a	21	-0.6±4.1 a			5	-15.3±4.3 a	5	-4.2±5.5 ab				
March - May	54	-0.8±1.2 a	53	-2.2±2.2 a	55	-1.1±1.2 a	18	-7.3±2.3 a	15	-8.1±2.9 a	15	0.0±2.0 a	10	0.4±1.8 a
June - September	18	2.0±1.6 a	17	2.8±2.6 a	22	1.1±1.2 a	44	22.6±2.9 b	41	10.3±3.7 b	23	-0.0±2.0 a	18	-0.4±1.8 a
Regression on body weight:														
		0.0032±0.0111		0.0079±0.0139		-0.00184±0.0105		-0.0020±0.0117		-0.0169±0.0117		-0.0041±0.0087		0.0067±0.0070
Afternoon respiration rate														
General mean	100	179.0±0.6	91	175.6±1.9	65	185.2±5.6	62	176.4±3.3	56	193.7±6.7	34	196.3±6.3	24	174.7±7.2
Sex:														
Male	46	-0.4±1.1 a	40	-2.4±1.4 a	27	-2.2±2.3 a	26	-0.1±1.2 a	23	0.3±2.2 a	9	-2.3±1.8 a	3	2.1±3.0 a
Female	54	0.4±1.1 a	51	2.4±1.4 a	38	2.2±2.3 a	36	0.1±1.2 a	33	-0.3±2.2 a	25	2.3±1.8 a	21	-2.1±3.0 a
Air temperature:														
< 20° C.	34	-15.6±3.2 a	23	-25.0±6.6 a										
20 - 29° C.	52	12.4±2.4 b	36	10.5±3.8 b	47	2.9±5.1 a	37	-1.7±1.4 a	22	-3.5±3.1 a	10	-5.5±2.3 a	5	-5.6±2.5 a
≥ 30° C.	14	4.2±4.3 b	32	14.5±4.0 b	18	-2.9±5.1 a	25	1.7±1.4 a	34	3.5±3.1 a	24	5.5±2.3 b	19	5.6±2.5 b
Season:														
December-February	28	-7.5±3.2 a	21	2.1±7.1 a										
March - May	54	-3.4±2.3 ab	53	-1.3±3.8 a	43	-7.0±4.8 a	18	-18.5±1.5 a	15	-9.0±3.6 a	11	2.6±2.2 a	6	5.5±2.8 a
June - September	18	3.0±4.0 b	17	-0.8±4.7 a	22	7.0±4.8 a	44	18.5±1.5 b	41	9.0±3.6 b	23	-2.6±2.2 a	18	-5.5±2.8 a
Regression on body weight:														
		-0.0137±0.0172		0.0125±0.0204		-0.0074±0.0252		-0.0039±0.0116		-0.0218±0.0187		-0.0090±0.0094		0.0190±0.0089

males and females of each breed had recorded nearly the same respiration rate either in the morning or in the afternoon at all ages studied (Tables 13,15 and 17). The same trend was found when considering males and females of all breeds, the averages of the means of respiration rate for males and females, respectively were 163.9 and 163.6 per minute in the morning and 186.4 and 186.5 per minute in the afternoon. The differences between the two sexes in all cases were statistically non-significant (Tables 14,16 and 18).

Johnson et al. (1957& 1958) in Newzealand white rabbits and Abdel-Malek (1967) in Giza white rabbits, however, found that respiration rate of males was lower than that of females .

Air temperature :

Results on the effects of air temperature in the morning and in the afternoon at different ages within breeds showed a general trend indicating the increase in respiration rate with the increase of air temperature (Tables 13, 15 and 17). The effect of air temperature on both morning and afternoon respiration rates was found to be highly significant ($p < 0.01$) at most ages (Tables 14,16 and 18). The averages of the means of respiration rate in rabbits of all breeds at all ages studied (5-16 weeks) also showed a rise in respiration rate with the rise of air temperature either in the morning or in the afternoon. This is because respiration rate for rabbits

Table (14): Least squares analysis of variance of factors affecting respiration rate in offspring of Giza White rabbits.

Source of variation	Weaning			6 weeks			8 weeks			10 weeks			14 weeks			16 weeks		
	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %
<u>Morning respiration rate</u>																		
Sex	1	42.12	0.00	1	94.21	0.00	1	10.86	0.00	1	4.33	0.00	1	10.76	0.00	1	3.54	0.00
Air temperature	1	12734.06 ^{MS}	83.46	1	22975.57 ^{MS}	38.08	1	1463.30 ^{MS}	16.88	1	346.18	5.16	1	636.97 ^{MS}	74.29	1	736.10 ^{MS}	85.22
Season	2	16.34	0.00	2	1336.88 ^{MS}	13.09	2	3398.23 ^{MS}	35.02	2	2784.19 ^{MS}	52.72	1	16.50	0.00	1	207.77	1.73
Regression on body weight	1	438.59 ^{MS}		1	16.40		1	40.24		1	43.36		1	69.20		1	49.38	
Residual	115	76.70	16.54	106	174.92	48.83	97	203.41	48.10	87	106.39	42.12	46	40.83	25.71	35	60.49	13.05
<u>Afternoon respiration rate</u>																		
Sex	1	223.82	0.00	1	895.33	1.28	1	545.98	0.20	1	43.00	0.00	1	17.85	0.00	1	287.6	0.00
Air temperature	2	15694.79 ^{MS}	66.32	2	4881.77 ^{MS}	33.98	1	6313.73 ^{MS}	22.14	1	122.77	0.00	1	21.62	0.00	1	163.0	0.00
Season	2	1987.75 ^{MS}	8.23	2	410.98	0.00	1	6566.87 ^{MS}	29.99	1	3055.48 ^{MS}	55.37	1	603.25 ^{MS}	21.08	1	830.7	8.01
Regression on body weight	1	3156.86 ^{MS}		1	49.86		1	567.68		1	441.23		1	72.72		1	856.1	
Residual	114	366.70	25.45	105	428.60	64.74	92	458.34	47.67	82	306.73	44.63	45	110.82	78.92	34	395.1	91.99

Table (16): Least squares analysis of variance of factors affecting respiration rate in off-spring Bauscat rabbits.

Source of variation	Weaning			6 weeks			8 weeks			10 weeks			12 weeks			14 weeks			16 weeks			
	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	
Morning respiration rate																						
Sex	1	25.82	0.00	1	235.98	0.00	1	1.19	0.00	1	5.81	0.00	1	0.66	0.00	1	11.34	0.00	1	84.41	0.13	
Air temperature	1	9849.52 ^{MS}	64.32	1	8103.66 ^{MS}	31.82	1	12415.04 ^{MS}	59.43	1	937.67 ^{MS}	22.00	1	1020.16 ^{MS}	13.80	1	2244.11 ^{MS}	50.95	1	2067.38 ^{MS}	72.75	
Season	2	1719.03 ^{MS}	10.71	2	1456.20 ^{MS}	5.55	1	1265.37 ^{MS}	6.20	2	4925.57 ^{MS}	47.38	2	6699.86 ^{MS}	43.07	1	1130.56 ^{MS}	10.67	1	17.20	0.00	
Regression on body weight	1	362.98 ^{MS}		1	17.05		1	625.84 ^{MS}		1	10.95		1	235.26		1	36.82		1	1.86		
Residual	188	70.21	24.97	180	381.86	62.63	173	134.09	34.37	151	85.21	30.62	135	190.84	43.13	82	98.59	30.38	73	73.15	27.12	
Afternoon respiration rate																						
Sex	1	2.15	0.00	1	10.03	0.00	1	380.47	0.00	1	547.27	0.89	1	96.02	0.00	1	509.44	1.59	1	8.02	0.00	
Air temperature	2	18507.59 ^{MS}	48.17	2	13672.48 ^{MS}	55.76	1	2832.85 ^{MS}	4.11	1	348.76	31.67	1	505.67	0.00	1	1602.17 ^{MS}	18.77	1	148.74	0.00	
Season	2	8419.09	25.68	2	193.25	0.00	1	36656.82	49.00	1	0.00	0.00	1	3041.70	32.90	1	345.16	0.41	1	4.89	0.00	
Regression on body weight	1	301.13		1	9.11		1	259.50		1	145.15		1	3589.65 ^{MS}		1	500.69		1	54.83		
Residual	187	237.88	26.15	179	545.89	44.24	152	547.70	46.89	138	282.87	67.44	128	651.13	67.10	73	308.89	79.23	67	271.55	100.00	

Table (18) : Least squares analysis of variance of factors affecting respiration rate in offspring of Grey Flazier rabbits.

Source of variation	Weaning			6 weeks			8 weeks			10 weeks			12 weeks			14 weeks			16 weeks		
	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %	d.f	Mean square	Variance %
Morning respiration rate																					
Sex	1	21.99	0.00	1	138.93	0.33	1	2.48	0.00	1	48.56	0.00	1	20.83	0.00	1	93.35	0.89	1	1.12	0.00
Air temperature	1	3131.13 ^{MS}	82.07	1	1715.56 ^{MS}	76.89	1	6597.24 ^{MS}	81.89	1	7.57	0.00	1	401.05	23.74	1	1149.01 ^{MS}	64.38	1	1956.10 ^{MS}	91.82
Season	2	51.25	0.00	2	166.20	1.41	1	60.01	0.00	2	4441.66 ^{MS}	80.89	2	1147.82 ^{MS}	35.14	1	0.04	0.00	1	2.05	0.00
Regression on body weight	1	4.20		1	40.78		1	203.22		1	2.36		1	242.21		1	15.47		1	32.82	
Residual	94	50.43	17.83	85	83.38	21.37	72	66.42	18.11	61	84.26	19.11	55	116.55	41.62	33	69.80	34.73	23	35.73	8.18
Afternoon respiration rate																					
Sex	1	12.74	0.00	1	517.22	2.65	1	290.16	0.00	1	0.93	0.00	1	6.20	0.00	1	122.05	3.18	1	27.54	0.00
Air temperature	2	3681.17 ^{MS}	68.86	2	1347.59 ^{MS}	33.85	1	108.41	0.00	1	119.08	0.24	1	336.96	1.75	1	414.55 ^{MS}	37.58	1	282.93 ^{MS}	33.16
Season	2	348.09	4.42	2	11.23	0.00	1	686.80	13.19	1	11992.31 ^{MS}	89.27	1	1720.75 ^{MS}	33.55	1	102.29	2.88	1	213.48	30.17
Regression on body weight	1	76.08		1	68.23		1	28.34		1	8.87		1	363.02		1	67.65		1	253.96 ^{MS}	
Residual	93	119.70	26.72	84	181.82	63.50	60	330.52	86.81	57	80.18	10.49	51	267.00	65.20	29	74.41	56.36	19	55.32	36.67

under air temperature of 20°C and $20\text{--}28^{\circ}\text{C}$ in the morning averaged 154.4 and 173.6 per minute, respectively, and that for rabbits under air temperature of 30 and $30\text{--}38^{\circ}\text{C}$ in the afternoon averaged 180.2 and 195.6 per minute, respectively. The differences being 19.2 per minute in the morning and 15.3 per minute in the afternoon. Therefore, one may consider that air temperature is an important factor which affect respiration rate in such a way that when air temperature increased heat dissipation, through respiratory system will be higher than other physiological processes. Thus, respiratory system can be considered a major mean by which the animal react physiologically due to variation in the environmental air temperature to keep body temperature within the normal limits.

The increase of respiration rate with the increase of air temperature observed in this study was also noticed by Johnson *et al.* (1957 & 1958) in New Zealand White rabbits, Abdel-Malek (1967) and Hassanein (1980) in Giza White rabbits.

The calculated averages of the means of respiration rate for the three breeds in the morning were found to range from 152.8 to 155.3 per minute under $< 20^{\circ}\text{C}$ and from 172.2 to 176.2 per minute under $\geq 20^{\circ}\text{C}$. The respective averages of the afternoon ranged from 179.6 to 181.4 per minute under $< 30^{\circ}\text{C}$ and from 187.6 to 200.9

per minute under $\geq 30^{\circ}\text{C}$. These information show that all breeds recorded in general nearly the same respiration rate within classes of air temperature and within time of measurement. This calls to note that effect of air temperature on respiration rate of rabbits of 5-16 weeks of age did not differ from breed to another.

Season:

Months from December to May were considered as winter months, while those from June to September were taken as summer months. Data presented in Tables 13, 15 and 17 showed that respiration rate in the morning or in the afternoon in summer months were generally higher than in winter months. Differences in respiration rate due to season of year were significant ($P \leq 0.05$ or ≤ 0.01) at most ages in the three breeds (Tables 14, 16 and 18). The averages of the means of the morning respiration rate (of rabbits in all ages) during winter and summer months, respectively, were 161.0 and 175.6 per minute for Giza White rabbits, 158.4 and 171.4 per minute for Bauscat rabbits and 159.2 and 168.5 per minute for Grey Flander rabbits. In the afternoon, the corresponding estimates were 184.7 and 189.9 per minute for Giza White, 181.1 and 196.7 for Bauscat and 175.8 and 187.9 per minute for Grey Flander. These averages show that respiration

rate in winter was always lower than in summer either in the morning or in the afternoon. This trend can be attributed to higher air temperatures during summer months (28.23 - 29.98°C) than during winter months (12.53 - 26.89°C) as presented in Table 2). This trend agree well with that reported on New Zealand White rabbits by Johnson et al. (1958) and on Giza White rabbits by Abdel-Malek (1967) and Shafie et al. (1970).

Body weight:

Constants of the regression of respiration rate on body weight of the rabbit showed a poor negative association between the two variables at most ages of the three breeds (Tables 13;15 and 17). No significant effect was observed for the effect of weight of rabbits on its respiration rate in the three breeds except at 5 weeks of age in Giza White rabbits in the morning and in the afternoon as well as at 5 and 8 weeks of age in the morning only in Bauscat rabbits (Tables 14, 16 and 18). These results show that weight of rabbit was not a pronounced factor influencing respiration rate.