PERFORMANCE OF GROWING MALE RABBITS AS AFFECTED BY FEEDING SYSTEM AND DIETARY *Nigella sativa* SEEDS SUPPLEMENTATION DURING MILD AND HOT PERIODS OF EGYPT

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ABSTRACT

One hundred and twenty New Zealand White growing rabbits were used to study the effects of period of the year (60 animals in the mild, and another 60 in the hot period), feeding system (30 *ad libitum* and 30 fed only at night per period), and *Nigella sativa* seeds dietary supplementation (0, 0.5 and 1% seeds, 10 animals per each group of *Nigella sativa* seeds dietary supplementation). The Temperature–humidity index (THI) values estimated were 18.9 and 29.7 at mild and hot periods, indicating absence of heat stress during the mild period and exposure to severe heat stress during the hot period. Exposure to severe heat stress decreased (P<0.01) feed intake (by 14.6%), live body weight (by 17.4%), daily live body gain (by 28.3%) than in the mild period. Dressing percentage and prime cuts percentage were also decreased (by 11.7 and 17.3%, respectively) in the hot period. Contrarily, heat stress increased (P<0.01) water intake (by 86.3%), feed conversion (by 19.85%), rectum temperature (by 2.6), respiration rate (by 14.5%) and serum urea-N (by 21.8%) by exposure to severe heat stress. Serum total proteins, albumin, globulin and creatinine were insignificantly affected by period of the year. Feeding growing rabbit only during the night improved (P<0.05) feed intake (by 6.8%), live body weight (by 5.6%) and daily live body gain (by 10.2%) compared to *ad libitum* feeding system during all day. Similarly, dressing percentage and prime cuts were increased (by 4.4 and 7.4%, respectively). Water consumption of animals fed only during the night decreased (by 22.5%; P<0.05) than of those fed all the day. Feed conversion rate, rectum temperature, respiration rate, serum total proteins, albumin, globulin, urea and creatinine, were insignificantly affected by feeding system. Dietary supplementation with 1.0% *Nigella sativa* seeds increased (P<0.05) feed intake, live body weight, serum total protein and serum globulin than without supplementation. Dressing percentage and prime cuts were also increased with *Nigella sativa* supplementation. Feed conversion, water consumption, daily live gain weight, rectum temperature, respiration rate, serum albumin, urea and creatinine were insignificantly affected with *Nigella sativa* seeds dietary supplementation. It is recommended to feed rabbits only at night, under the warm sub-tropical environmental conditions and to supplement growing rabbits with 1.0% *N. sativa* seeds. All interaction effects between period of the year and feeding system on the studied traits were not significant. Therefore, the main effects were only discussed.

Key words*: feeding system, heat stress, Nigella sativa seeds dietary supplementation, growing rabbit traits.*

INTRODUCTION

Intensive rabbit production economics are affected by many factors, particularly environment and nutrition. However, under the sub-tropical conditions, the combined effect of such factors may be more substantial due to the negative effect of elevated ambient temperature on appetite and accordingly on the feed intake that ends with slowing growth in rabbits **(Abdel–Monem, 2001; Marai *et al.,* 2002 and 2006).** Such phenomenon may suggest to feed rabbits at the mildest period of the day during the hot period of the year, under the sub-tropical conditions.

Nigella sativa seeds and their meal are becoming commonly used as feed additives and medical purposes. Medically, *Nigella sativa* is known with its antibacterial, antifungal, antihelminthic, antineoplastic, bronchodilator, immune, and antispasmodic effects **(Rathee *et al*., 1982; Mahdy, 1993; Khodary *et al*., 1996).** Besides that the *Nigella sativa* has blood pressure regulating and bile flow stimulating effects.

The present study was conducted to investigate the effects of period of the year (mild and hot), feeding system (*ad libitum* and feeding only at night), *Nigella sativa* seeds dietary supplementation (0, 0.5 and 1%) and their interactions on performance traits, thermoregulation parameters, immunity and kidney function under Egyptian sub-tropical conditions.

MATERIALS AND METHODS

The study was carried out at the Department of Animal Production, Faculty of Agriculture, Zagazig University, Zagazig, Egypt. The practical work was conducted in a farm in Zagazig city during two periods of the year: hot (from May to September, 2005), and mild (from October, 2005 to April, 2006).

Sixty New Zealand White (NZW) growing male rabbits of 6 weeks of age during each period of the year (hot or mild) were randomly divided into 6 treatment groups (10 animals/group), in order to study the productive traits as affected by period of the year, feeding system (*ad libitum* and fed only at night from 20.00 PM to 8.00 AM), *Nigella sativa* dietary supplementation (0, 0.5 and 1% seeds) and their interactions, under Egyptian conditions. Nutritionally, the Egyptian *Nigella sativa* seeds composition was shown in Table 1. All groups were nearly similar in average initial body weights.

The basal diet contained: 28.0% alfalfa hay, 18.0% barley, 18.0% soybean meal (44.0% CP), 25.0% wheat bran, 6.0% yellow corn, 3.0 % molasses, 1.1% limestone, 0.3% sodium chloride and 0.6% vitamin and mineral premix. Each kilogram of vitamin and minerals premix contained: Vit. A 10.000 IU, Vit. D_3 900 IU, Vit. K 2 mg, Vit. E 50 mg, Vit. B1 2 mg, Vit. B_2 6 mg, Vit. B_6 2 mg, Vit. B_{12} 0.01 mg, Pantathonic acid 20mg, Niacin 50 mg, Folic acid 5 mg, Biotin 1.2 mg, Choline 12000 mg, Copper 3 mg, Iodine 0.2 mg, Iron 75 mg, Manganese 30 mg, Zinc 70 mg, Selenium 0.1 mg, Cobalt 0.1 mg and Magnesium 0.04 mg. The basal diet contained of 18.2 % crude protein, 13.4% crude fibre, 2.3% ether extract, and 2656 kcal/kg digestible energy. The digestible energy value was estimated by calculation.

All rabbits were kept under identical managerial, hygienic and environmental conditions and were maintained and treated according to the accepted standards for the human treatment of animals.

The growing rabbits were reared in wire cages, in a well ventilated building. Fresh water was available all the time by stainless steel nipples. Each cage was equipped with a feeder and a graded crock (container) containing

drinking water. Feed or water consumption was estimated once a week by measuring the offered and residuals for each rabbit group.

Means of ambient temperature and relative humidity at mid-day inside the rabbitry during the experimental period were 19.4°C and 70.3% in the mild period and 31.0°C and 75.3% in the hot period, respectively.

Table 1. Composition of Nigella sativa seeds .

Some nutrients and amino acid contents		**Mineral contents (Mg/kg)[5]**		**fatty acids contents (%)**	
Constituents:	(%)			**Saturated fatty acids**	
Crude protein	21.0-34.0 [1]	Calcium	3.0	(total)	11.8[3]
Ether extract	11.0-37.0[1]	Phosphorus	9.3		
Crude fibre	5.8-16.4 [1]	Iron	4.6	**Unsaturated acids**	
		Zinc	0.9	contents:	
Amino acids contents:	(g/100g)	Manganese Copper	0.3	Oleic acid	48.8[3],
Aspartic acid	9.55 [2]	Sodium	0.3		24.0[4]
Threonine	4.07 [2]	Potassium	0.2	Linoleic acid	37.6[3]
Serine	4.12 [2]	Magnesium	0.4		56.0[4]
Glutamic acid	22.51[2]		7.1	Linolenic acid	1.9[3]
Glysine	6.5[2]			Palamatic acid	0.7 [4]
Alanine	4.52[2]			Stearic acid	3.0[4]
Cysteine	1.07[2]			Eicosadienoic acid	2.9 [4]
Valine	5.2[2]			Myrestic acid	0.2 [4]
Methionine	1.47[2]				

1, (Abdel–Aal and Attia 1993; Khalifah, 1995; Zeweil, 1996; Salah, 1997)

2, (Khalifah, 1995; Zeweil, 1996; Salah, 1997)

3, (Gad *et al.*, 1963). 4, (Babayan *et al.*, 1978) . 5, (Nasr *et al.*, 1996; Khalifah, 1995)

The performance traits were studied such as feed intake, feed conversion, water intake, live body weight, live body gain and dressing percentage. Rectal temperature and respiration rate were measured in growing NZW rabbits every two weeks from 12.00 – to 2.00 PM.. Respiration rate was recorded by counting the frequency of the flank movement per minute by using a hand counter. Internal body temperature was measured by medical thermometer inserted into the rectum at depth of 2 cm for 2 minutes.

At the end of the experimental period, blood samples were collected during slaughter of the animals into dry clean centrifuge tubes containing some drops of heparin in less than 2 minutes, after shaving and cleaning with alcohol. Plasma was separated by centrifugation at 3000 rpm for 20 minutes and kept in a deep freezer at -20°C until analysed. Total proteins, albumin, creatinine and urea concentrations in plasma were estimated using commercial kits (Bio Merieux, France) according to the procedure outlined by the manufacturer. Globulin values were obtained by subtracting the values of albumin from the corresponding values of total proteins.

In order to study the combined effects of temperature and humidity, temperature humidity index (THI) was calculated according to the formula of **Marai *et al.* (2001)** modified from the formula of **LPHSI (1990)** as follows:

$$THI = db^{o}C - [(0.31 - 0.31RH)(db^{o}C - 14.4)],$$

where $db^{o}C$= dry bulb temperature in Celsius and RH = RH % /100. A value for THI below 27.8 was taken to signify an absence of heat stress, while a value in excess of 28.9 was considered to represent severe heat stress.

Statistically, the obtained data were analyzed as a 2 × 2 × 3 factorial design according to **Snedecor and Cochran (1982)** by the following model:

$$X_{ijkl} = \mu + P_i + F_j + N_k + PF_{ij} + FN_{jk} + PN_{ik} + PFN_{ijk} + E_{ijkl},$$

where X_{ijkl} = an observation, μ = general mean, P_i = fixed effect of i_{th} period of the year (i = 1 and 2), F_j = fixed effect of j feeding system (j =1 and 2), N_k = fixed effect of k *Nigella sativa* seeds supplementation (k =1,2 and 3), PF_{ij} = interaction between period of the year and feeding system, FN_{jk} = interaction between feeding system and *Nigella sativa* seeds supplementation, PN_{ik} = interaction between period of the year and *Nigella sativa* seeds supplementation, PFN_{ijk} = interaction between period of the year, feeding system and *Nigella sativa* seeds supplementation, and E_{ijkl} = random error. Differences among means were tested by Duncan's multiple range test **(Duncan 1955).**

RESULTS AND DISCUSSION

Due to that all interaction effects between period of the year and feeding system on the studied traits were not significant, the main effects were only discussed.

Effect of period of the year

Temperature – humidity index values (THI) estimated were 18.9 and 29.7 for mild and hot periods, respectively, indicating absence of heat stress during the mild period and exposure to severe heat stress during the hot period. These results were similar to those of **Marai *et al.* (1996)** under the same Egyptian climatic conditions.

Exposure of NZW growing male rabbits to severe heat stress under the warm sub-tropical environmental conditions of Egypt, decreased significantly ($P<0.01$) feed intake (by 14.6%), live body weight (by 17.4%) and daily body gain (by 28.3%). The dressing (%) and prime cuts (%) were also decreased with 11.7 and 17.3%, respectively, by exposure to severe heat stress (Tables 2-4). However, heat stress increased ($P<0.01$) water intake (by 86.3%), rectum temperature (by 2.6%), respiration rate (by 14.5%), serum urea-N (by 21.8%). Feed conversion also was significantly ($P<0.01$) increased (by 19.85%) during the hot period. Serum total proteins, albumin, globulin and creatinine were insignificantly affected by period of the year (Tables 2, 3, 4 and 5).

Under heat stress conditions, depression in feed consumption is the most important reaction to exposure to elevated temperature **(Marai *et al.* 2002).** Such phenomenon is due to that environmental temperature stimulates the peripheral thermal receptors to transmit suppressive nerve impulses to the appetite centre in the hypothalamus causing the decrease in feed consumption, and consequently less substrates become available for enzymatic activities, hormone synthesis and heat production **(Marai *et al.* 2002).**

The high consumption of water in the hot period helps the animal to increase the heat loss through water respiratory vaporization. **Stephan (1980)** estimated the increase in water requirements by 50% at 38˚C compared to 18.0˚C, in growing rabbits.

The high increases in thermoregulatory parameters (rectum temperature and respiration rate) due to exposure to severe heat stress were similar to those reported by other workers **(Rich and Alliston 1970; Shafie *et al.* 1984; Marai *et al.* 2001).** The increase in respiration frequency and evaporative water loss is linearly related to the increase in ambient temperature above the panting threshold **(Richards, 1976)** and thus enables the animals to dissipate heat by vaporizing high moisture through the respiratory air, which accounts for around 30% of total heat dissipation. Respiration becomes the main pathway for loss of the latent heat, since most sweat glands in rabbits are not functional and perspiration is not great due to the fur **(Marai *et al.* 2001).** The increase in

rectal temperature of the heat-stressed rabbits may be due to failure of the physiological mechanisms of the animals to balance the excessive heat load caused by exposure to high ambient temperature **(Habeeb *et al.* 1992).**

In short, exposure of rabbits to heat stress evokes a series of remarkable changes in their biological functions which end with impairment of production **(Marai *et al*. 2002).**

Effect of feeding system

Feeding growing rabbits only during the night improved (P<0.05) feed intake (by 6.8%), live body weight (by 5.6%) and daily body gain (by 10.2%) (Tables 2 and 3). Dressing (%) and prime cuts (%) were improved with 4.4 and 7.4%, respectively, than with an *ad libitum* feeding system during all day (Table 4). Water consumption decreased (by 22.5 %; P<0.05) in animals fed only during the night compared to those fed all the day. Feed conversion rate, rectum temperature, respiration rate, serum total proteins, albumin, globulin, urea and creatinine, were insignificantly affected by feeding system (Tables 2, 3, 4 and 5). The present results were similar to those obtained by **Mahrose (2000).**

Table 2. Means ±SE of feed intake, feed conversion and water intake of New Zealand White growing male rabbits as affected by period of the year, feeding system, and dietary supplementation with *Nigella sativa* seeds[1].

Items	Feed intake ((g /d)	Feed conversion rate(g feed/g gain)	W Water intake (ml /d)
Period of the year			
Hot	88.0±3.1	5.99±0.06	215.6±3.9
Mild	103.1±.2.2	5.0±0.08	115.7±5.4
Significance	**	**	**
Feeding system			
Ad libitum	99.2±4.1	5.9±0.02	165.7±4.2
Feeding only at night	105.5±3.9	5.7±0.06	128.4±4.1
Significance	*	N**NS**	*
***Nigella sativa* seeds supplementation (%)**			
0.0	92.5±3.0[b]	5.5±0.06	173.5±5.1
0.5	96.7±4.2 [b]	5.6±0.05	169.1±4.5
1.0	100.1±4.9 [a]	5.4±0.01	170.8±4.7
Significance	*	**NS**	**NS**

[1]n= 10 rabbits per each combination of period, feeding system and *N. sativa* level.

Means bearing different letters in the same column within each classification, differ significantly (P≤0.05).

** = P<0.01, * = P<0.05 and N.S. = Not significant.

The favourable effects of feeding only during night may be due to the increase in feed consumption as a positive reflection to deprivation of the feed during the daylight, in addition to improvement of appetite during the mildest environment at night under the sub-tropical warm conditions. This is besides the stimulating effects of the nocturnal nature of rabbits. Improvement of the appetite by night is a result to stimulation of the peripheral thermal receptors by the mild environmental temperature to transmit suppressive nerve impulses to the appetite centre in the hypothalamus that causes the mentioned phenomenon **(Marai *et al.*, 2002).**

The significant decrease in water consumption when rabbits were fed only at night compared with those fed *ad libitum* all the day, may be due to the effect of milder weather at night than during daylight.

Generally, under the sub-tropical conditions, the combined effect of environment and nutrition is more substantial than in the other areas with milder climate, due to the negative effect of elevation ambient temperature on appetite and accordingly on feed intake that ends with slowing growth in rabbits **(Abdel – Monem 2001; Marai *et al.* 2002, 2006).** These results may suggest to feed rabbits at the mildest period of the day specially during the hot period of the year, under the sub-tropical conditions.

Table 3. Means ±SE of body weight and body gain weight of growing NZW male rabbits as affected by period of the year, feeding system and *Nigella sativa* seeds dietary supplementation[1].

Items	W0	W4	W8	G0-4	G4-8	G0-8
Period of the year						
Hot	713.1±1.31	1224.8 ±8.0	1535.0 ±10.0	18.3±0.3	11.1 ±0.3	14.7±0.2
Mild	712.9±2.54	1320.8±3.7	1858.2±12.8	21.7±0.2	19.2±0.4	20.5±0.2
Significance	N.S	**	**	**	**	**
Feeding system						
Ad libitum	715.7±1.1	1247.2 ±9.9	1650.6±20.0	19.0±0.4	14.4 ±0.8	16.7±0.4
Only at night	710.5±2.6	1298.5 ±6.0	1742.6 ±25.1	21.0±0.2	15.9±0.7	18.4±0.5
Significance	N.S	*	*	*	N.S	*
***Nigella sativa* seeds supplementation (%)**						
0.0	713.9±1.7	1252.3 ^{b}±12.0	1649.4 ^{b}±28.1	19.2 ±0.4	14.2 ^{b} ±0.8	16.7±0.4
0.5	712.0±2.7	1273.5^{ab}±10.4	1687.0^{ab}±28.3	20.1 ±0.4	14.8 ^{ab} ±0.7	17.4±0.4
1.0	713.31±2.9	1292.8 ^{a}±14.0	1753.5 ^{a}±28.9	20.7 ±0.3	16.5 ^{a} ±0.8	18.6±0.3
Significance	N.S	*	*	N.S	*	N.S

[1]n= 10 rabbits per each combination of period, feeding system and *N. sativa* level.
Means bearing different letters in the same column within each classification, differ significantly (P≤0.05).
** = P<0.01, * = P<0.05 and N.S. = Not significant.

Dietary supplementation with *Nigella sativa* seeds

Dietary supplementation the growing rabbits with 1.0% *Nigella sativa* seeds increased (P<0.05) feed intake, final live body weight, and serum total protein, serum globulin compared to feeding without *Nigella sativa* supplementation (Tables 2, 3 and 5). Dietary supplementation with 1% *Nigella sativa* seeds also improved the dressing % and prime cuts % than the control one. Feed conversion, water consumption, daily gain weight, rectum temperature, respiration rate, serum albumin, urea and creatinine were insignificantly affected with dietary supplementation (Tables 2, 3, 4 and 5).

The favourable effects of dietary supplementation of *Nigella sativa* seeds on growing rabbits might be due to the seeds beneficial properties either nutritionally or medicinal properties.

Table 4. Means (±SE) of rectum temperature, respiration rate, dressing percentage and prime cuts percentage of New Zealand White growing male rabbits as affected by period of the year, feeding system and dietary supplementation with *Nigella sativa* seeds[1].

Items	Rectum temperature (^{o}C)	Respiration rate (Respirations/ minute)	Dressing(2) (%)	Prime cuts(2) (%)
Period of the year				
Hot	39.9±0.4	104.8±0.5	57.4	49.3
Mild	38.9±0.3	91.5±0.3	65.0	59.6
Significance	**	**		
Feeding system				
Ad libitum	39.4±0.6	99.9±1.02	59.3	51.1
Feeding only at night	39.5±0.4	96.3±0.82	61.9	54.9
Significance	NS	NS		
***Nigella sativa* seeds supplementation (%)**				
0.0	39.3±0.3	99.2±1.3	59.5	50.7
0.5	39.4±0.4	97.9±1.2	60.9	51.5
1.0	39.4±0.5	97.2±1.0	62.8	53.2
Significance	NS	NS		

[1] n = 10 rabbits per each combination of period, feeding system and N. sativa level.

Means bearing different letters in the same column within each classification, differ significantly (P≤0.05).

** = P<0.01 and N.S. = Not significant. .(2),The data of this character were not statistically analyzed.

Table 5. Means ±SE of some blood metabolites of New Zealand White growing male rabbits as affected by period of the year, feeding system and dietary supplementation with *Nigella sativa* seeds

Items	Total proteins (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Urea (mg/dl)	Creatinine (mg/dl)
Period of the year					
Hot	6.9±0.27	3.7±0.3	3.2±0.2	17.9±0.7	1.4±0.2
Mild	7.2±0.32	4.1±0.5	3.1±0.3	14.7±0.6	1.1±0.1
Significance	NS	NS	NS	**	NS
Feeding system					
Ad libitum	7.8±0.39	4.3±0.3	3.5±0.3	15.9±0.8	1.3±0.2
Feeding only at night	8.0±0.34	4.1±0.4	3.9±0.5	15.6±0.5	1.1±0.3
Significance	NS	NS	NS	NS	NS
Nigella sativa supplementation (%)					
0.0	6.9 ^{b} ±0.41	4.0±0.3	2.9 ^{b} ±0.4	15.1±0.8	1.2±0.2
0.5	7.1 ^{ab}±0.50	4.0±0.2	3.1 ^{b} ±0.3	15.4±0.8	1.5±0.1
1.0	7.4 ^{a} ±0.39	3.9±0.4	3.5 ^{A} ±0.3	15.0±0.7	1.4±0.1
Significance	*	NS	*	NS	NS

[1]n= 10 rabbits per each combination of period, feeding system and *N. sativa* level.

** = P<0.01, * P<0.05 and N.S. = Not significant..

Conclusions

The negative effects of exposure of growing rabbits to severe heat stress under the warm sub-tropical environmental conditions of Egypt, may suggest to feed rabbits at night only during either the mildest period of the day (during night) especially during the hot period of the year, under the sub-tropical

conditions. This could minimize productive losses. It may be also recommended to supplement the growing rabbits diets with *Nigella sativa* seeds (1.0%), although further studies are needed to test inclusion of different percentages of the same feedstuff for the same purpose.

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أداء ذكور الأرانب النامية المتأثرة بنظام التغذية والإضافة الغذائية لبذور الحبة السوداء أثناء الفترة المعتدلة و الحارة في مصر

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استخدم في هذه الدراسة مائة عشرون أرانب نيوزيلندي ابيض نامي لدِراسَة تأثير فترةِ السَنَةِ حيث استخدم (٦٠ أرنب في الفترة المعتدلة، و٦٠ آخر في الفترةِ الحارةِ)، وفي كل فترة كان يوجد نظامين تغذية وفي كل نظام تغذية (٣٠ أرنب في نظام التغذية للشبع و٣٠ أرنب في نظام التغذية الليلية فقط)، وتحت كل نظام تغذية يوجد ثلاث مستويات من إضافة بذور حبة البركة (٠، ٠.٥ و١% بذور/كجم عليقة، ١٠ حيواناتِ لكلّ مجموعةِ من الإضافة ببذور حبة البركة).

وكانت قيم دليل درجةَ الحرارة و الرطوبةِ (**THI**) هي ١٨.٩- ٢٩.٧ في الفتراتِ المعتدلةِ والحارةِ على التوالي، وهذه القيم تشير إلى غيابِ الإجهادِ الحرارةِ أثناء الفترةِ المعتدلةِ وتعرّض الأرانب إلى الإجهادِ الحرارةِ الحادِّ أثناء الفترةِ الحارةِ.

والتعرّض إلى الإجهادِ الحرارةِ الحادِّ أدي إلي نَقصَ معنوي بمستوي ($P<0.01$) في كمية الغذاءِ المأكول (بحوالي الـ١٤.٦ %)، وزن الجسمِ الحيِّ (بحوالي الـ١٧.٤ %)، والزيادة اليومية في وزن الجسمِ الحيِّ (بحوالي الـ٢٨.٣ %) مقارنة بالفترةِ المعتدلةِ.

أيضا نسبة التصافي ونسبة قطعيات الدرجة الأولي نُقِصتْ (بحوالي ١١.٧-١٧.٣%، على التوالي) في الفترة الحارة. وعلي العكس نجد أن تعرض الأرانب النامية للإجهاد الحرارةِ زادَ معنويا بمستوي ($P<0.01$) كلا من كمية الماءِ المشروب (بحوالي الـ٨٦.٣%)، وكفاءة تحويل الغذاءِ (بحوالي الـ ١٩.٨٥%)، درجة حرارة المستقيمِ (بحوالي الـ ٢.٦)، معدل التنفسِ (بحوالي الـ ١٤.٥%) و يوريا الدم (بحوالي الـ٢١.٨%) عند تعرض الأرانب النامية إلى الإجهادِ الحرارةِ الحادِّ. في حين وجد ان بروتين الدم الكلي، الالبيومين، الجلوبيولين والكرياتينين لم يتأثروا بدرجة معنوية بفترةِ السَنَةِ. وقد وجد أن تغذية الأرانب النامية ليلا فقط قد حسّنَ معنويا بمستوي ($P<0.05$) كلا من كمية الغذاءِ المأكول (بحوالي الـ٦.٨ %)، وزن الجسمِ الحيِّ (بحوالي الـ٥.٦%) والزيادة اليومية في وزن الجسم الحي (بحوالي الـ١٠.٢%) مقَارنَة بنظام التَغْذِية حني الشبع طِوال النهار.

أيضا نسبة التصافي ونسبة قطعيات الدرجة الأولي قد زادت (بحوالي ٤.٤-٧.٤%، على التوالي). بينما وجد ان استهلاك الماءِ المشروب قد انخفض معنويا (بحوالي الـ ٢٢.٥%؛ $P<0.05$) في الحيوانات التي تم تغذيتها ليلا فقط مقارنة بالحيوانات التي تم تغذيتها طِوال اليوم. وقد اثر نظام التغذية بدرجة غير معنوية علي كلا من كفاءة تحويلِ الغذاءِ، درجة حرارة المستقيمِ، معدل التنفسِ، بروتين الدمِ الكليِّ، الالبيومين، واليوريا والجلوبيولين والكرياتينين.

إضافة بذور حبة البركة بمستوي ١.٠%/كجم عليقة أدي إلي زيادة معنوية بمستوي ($P<0.05$) في كلا من كمية الغذاءِ المأكول، وزن الجسمِ الحيِّ، بروتين الدمِ الكليِّ والجلوبيولين عند المقارنة مع المجاميع التي لم تتناول نفس الإضافة. كما أن نسبة التصافي ونسبة قطعيات الدرجة الاولي زادوا أيضاً مَع إضافة بذور حبة البركة. كما أن إضافة بذور حبة البركة قد أثرت بدرجة غير معنوية علي كلا من كفاءة تحويل الغذاءِ، إستهلاك الماءِ المشروب، والزيادة اليومية في وزن الجسم، درجة حرارة المستقيمِ، معدل التنفسِ، الالبيومين، اليوريا والكرياتينين.

من هذه النتائج يمكن التوصية بإتباع نظام التغذية الليلية والإضافة الغذائية لبذور الحبة السوداء (مستوى ١% بذور/كجم علف) وخاصة أثناء الفترة الحارة من العام وذلك لتحسين صفات النمو في الأرانب. كما أن التداخلات المختلفة بين كلا من فترة السنة ونظام التغذية وإضافة بذور حبة البركة كانت غير معنوية.