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CHANGING FEEDING TIME TO AVOID THE HARMFUL EFFECTS OF HOT SUMMER ON PERFORMANCE OF GROWING NEW ZEALAND WHITE RABBITS

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This experiment was conducted to investigate the effects of feeding times (at morning or afternoon) on productive performance of growing New Zealand White (NZW) rabbits in the hot summer of Assiut, Upper Egypt. Sixty-five male weaned rabbits, six weeks old of age with an average (734.8g), were reared in batteries and assigned to 4 groups (16 rabbits/each). Rabbits were divided into randomly five experimental groups (13 rabbits per each), during experimental period from 6 to 16 weeks of age. The first group as a control (C), the feed was offered ad libitum daily. While, in the second treated group (T1), rabbits were fed during10:00 and 16:00 h. The third group (T2) was fed during 16:00 to 22:00 h. The fourth group (T3) was fed during 22:00 to 04:00 h. The fifth group (T4) was fed at 04:00 to 10:00 h during the experimental periods from 6 to16 weeks of age.

The results showed that *there were significant (P<0.05) differences in body weight (at 12, 14 and 16 weeks of age), body weight gain (during 14-16 and 6-16 weeks of age), feed intake (during 14-16 weeks of age) and feed conversion ratio (during 14-16 and 6-16 weeks of age) among all groups. The rabbits belonging to T3 group had the greatest averages and the lowest feed conversion ratio when compared with the other groups.*

The rabbits were fed during 2200 to 0400h showed significantly (P<0.05) the highest percentages of dressed weight as compared with their counterparts. However, rabbits of the control group gave significantly (P<0.05) the lowest average of whole fat percentage in comparison with the other experimental groups. Non-significant differences were found in the other carcass characteristics due to changing feeding time.

Rabbits of T3 group showed the lowest (P<0.05) values of albumin/ globulin ratio (A/G) and neutrophil/ lymphocytes (N/L) ratio when compared with their counterparts. Glucose concentration was high (P<0.05) in plasma of rabbits of the control group and those fed during 22:00 to 04:00 h. Body temperature of rabbits fed during 22:00 to 04:00 h had the lowest temperature as compared with the other groups. There were non-significant differences in morbidity, mortality and health risk percentages.

***Conclusively**, it could be concluded from the present results, that changing feeding time in growing rabbits during 22:00 to 04:00 h had beneficial impacts on their performance. Finally, feeding growing rabbits during 22:00 to 04:00 as recommended in the hot summer.*

Key words: Feeding time, growth performance, carcass characteristics, hot summer, rabbits.

Productive and health performance of rabbits are affected by several environmental and managerial impacts such as high air temperature, relative humidity, lighting, feeding, housing, overcrowding, handling and transportation ...etc (Mahrose *et al*., 2010; Farghly and Hamdon 2015, 2016 and 2017). High air temperature and relative humidity(%) are one of the major problems that confront rabbit producers in tropical and sub-tropical regions (Mahrose, 2000; Farghly, 2011; Hassan *et al.*, 2016; Farghly and Hamdon 2017), where it influences rabbit performance (Marai *et al*., 2004; Farghly *et al*., 2016 and 2017).

Changing or restriction of feeding time in growing rabbits was studied in the last decades as a method to alleviate the deleterious influences of heat stress (Abdel-Monem *et al*., 2007; Mahrose *et al*., 2010 and Sena *et al*., 2012), to improve biological performance (Tůmová *et al*., 2006; Xiccato and Trocino, 2010 and Farghly *et al*., 2017) and can avoid feed losses. Feeding planning in growing rabbits should be applied to get the highest weights at marketing and the lowest feed conversion (Farghly and Abdelnabi, 2014; Sena *et al*., 2012 and 2015). Feeding behavior can be influenced by diurnal rhythms (Ojebiyi *et al*., 2015).

Rabbits consume feed at any time in the day, though they prefer to feed nocturnally (Abd El-Monem *et al*., 2007 and Farghly and Abd El-Ati, 2011). Rabbits consume 60-70% of the feed at night, before dawn and after dusk (Schlolaut, 1984, Gidenne *et al.*, 2010 and Ojebiyi *et al*., 2015). The feeding habits of the wild rabbits are even more nocturnal than those of domesticated

rabbits (Lebas *et al*., 1986). Although, there are three top intervals of feed intake a day in the rabbits; these are during 3:00-06:00, 15:00-18:00 and 18:00-21:00 h (Ogbu *et al*., 2014).

Restricting the feeding time could be a suitable method for reducing feed intake and improving feed conversion (Matics *et al*., 2012 and Uhlířoval *et al*., 2015).When restricted feeding time is applied, there may be raise in feed efficiency (Tůmová *et al*., 2003 and 2006; Dalle-Zotte *et al*., 2005 and de Oliveira *et al*., 2012), compensatory growth (Gidenne *et al*., 2012) and carcass characteristics should be consider (reducing fat deposition) when estimating alternative feeding programs (Yakubu *et al*., 2007; de Oliveira *et al*., 2012 and Chodová *et al*., 2017). As well as, feeding time of the day influences certain behaviors as feeding, the total activity in rabbits (Ogbu *et al*., 2014), the biochemical parameters (Chodová and Tůmová, 2013 and Chodová *et al*., 2017) and can be a prohibition against digestive-disorders (Tůmová *et al*., 2006).The effect of feed restriction relies on the duration of restriction, its intensity and the time of application (Chodová and Tůmová, 2013).

Therefore, the present work was designed to determine the effects of changing feed restriction time on growth performance, carcass characteristics, blood biochemical parameters and some health aspects during the summer season under conditions of Assiut Governorate, Egypt.

MATERIALS AND METHODS

The present experiment was carried out at the Research Poultry Farm of Poultry Production Department, Faculty of Agriculture, Assiut University, Assiut, Egypt. The work lasted for 10 weeks in summer season (July to August), where the environmental temperature ranged between 25.6°C to 36.4 °C while, relative humidity (%) was from 40.4 to 61.4%.Values of the ambient temperature, relative humidity and temperature-humidity index (THI) are presented in Table 1. Values of THI were calculated according to the formula of Marai *et al.* (2001) as follows:

$$THI = db\,C^{o} - \{(0.31 - 0.31RH)(db\,C^{o} - 14)\},$$

Where db C^{o} = dry bulb temperature in Celsius and RH = RH % /100. The estimated values of THI were classified as follows: <22.2 = Absence of heat stress, 22.2 – <23.2= Moderate heat stress, 23.3 –<25.5 = Severe heat stress and 25.5 and more = very severe heat stress.

Experimental animals and design:

Sixty-five of growing male New Zealand White (NZW) rabbits, six weeks old, were randomly divided into five experimental groups (13 rabbits per each). In the control group (C), the feed was offered *ad libitum* daily.

Table 1. Means of indoor air temperature and humidity values, during summer season

Intervals (month)	Temperature (C°)			Humidity (%)			THI		
	Max.	**Min**	**Av.**	**Max.**	**Min.**	**Av.**	**Max.**	**Min.**	**Av.**
June	33.88	24.64	29.26	59.85	42.23	51.04	31.46	22.81	27.00
July	35.00	27.11	31.06	62.00	44.52	53.26	32.57	24.92	28.64
August	35.92	26.86	31.39	61.22	43.00	52.11	33.33	24.66	28.87
Overall mean	**34.93**	**26.20**	**30.57**	**61.02**	**43.25**	**52.14**	**32.45**	**24.13**	**28.17**

Max = Maximum, Min= Minimum, Av. = average and THI = Temperature-humidity index.

While, in the first treated group (T1), rabbits were fed during10:00 and 16:00 h. The second group (T2) was fed during 16:00 to 22:00 h. The third treatment group (T3) was fed during 22:00 to 04:00 h. The fourth treatment group (T4) was fed at 04:00 to10:00 h, throughout the experimental period from 6 to 16 weeks of age.

Light intensity measured at the middle of the cages ranged between 25-30 lux. using incandescent bulbs in semi-closed house. Rabbits were ear tagged housed in a wire galvanized battery cages (50L × 55W × 40H cm), which supplied with feeders and automatic nipple drinkers. Rabbits were fed basal diet contained 2670 ME/kcal, 18.25% CP and 11.17% CF (weaning and up to marketing age) according to NRC (1977). Rabbits were reared under the same managerial, feeding and hygienic conditions throughout the experimental period.

***Investigated measurements*:**

Exterior and interior temperature (°C) and relative humidity (%) were measured by using a thermo hygrograph allover the experimental period. The daily and periodical (4weeks) averages environmental temperature and RH were recorded (Table 1).

Studied parameters:

Weaned rabbits were weighed at the beginning of the experiment (6 weeks of age) and every two weeks thereafter up to 16 weeks on individual basis to the nearest gram. Feed intake (FI) was recorded individually at 14-d intervals to be used in calculating feed conversion ratio (FCR) at intervals of 6-8, 8-10, 10-12, 12-14 and 14-16 weeks of age. Feed conversion ratio (FCR) was calculated as feed consumed divided by weight gain. Rectal temperature (ºC) was measured by using a thermometer inserted into the rectum for 2

minutes at depth of 2 cm in midday (14:00h). Dead rabbits were recorded daily and expressed as percentage during the experimental period.

At the end of the experiment (16 weeks of age), 4 rabbits per group was randomly chosen and slaughtered. Carcass weight was considered as the weight of fore part, intermediate part and hind part. The weight of additional edible parts included the weight of the liver, heart and kidneys as giblet weight.

At slaughter, 6 blood samples were taken in two tubes, one contained EDTA and the other had no anticoagulant. Plasma was separated by centrifugation at 3000 rpm for 20 minutes and kept in a deep freezer at -20 C until the time of analysis. Plasma total protein, albumin, globulin, albumin: globulin ratio, cholesterol, total lipids, glucose, cortisol, AST and ALT were determined by enzymatic method using available commercial kits. Globulin was calculated by subtraction of Plasma albumin from total plasma protein. Morbidity corresponded to frequency of enteric disease or severe loss of weight. Health risk was the sum of morbidity and mortality.

***Statistical analysis*:**

Data collected were subjected to ANOVA by applying the General Linear Models Procedure of SAS software (SAS institute, version 6.12, 1996). The following model according to Snedecor and Cochran (1982) was used for analysis of variance:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where: Y_{ij} = observation, μ = Overall mean, T_i = Treatment effect (i= 1, 2….5), e_{ij} = Experimental errors. The individual rabbit was the experimental unit in the present study.

Duncan (1955) was used to detect differences among means of different groups.

RESULTS AND DISCUSION

1. *Growth performance*:

There were significant ($P<0.05$) differences in body weight (at 12,14 and 16 weeks of age), body weight gain (during14-16 and 6-16 weeks of age), feed intake (during 14-16 weeks of age) and feed conversion ratio (during14-16 and 6-16 weeks of age) among all groups (Table 2).

The rabbits belonging to T3 group had the greatest averages and the lowest feed conversion ratio when compared with the other groups. In the current work, there are appropriate impacts on growth performance attributed to changing feeding times. During the coolest intervals of the day

of the summer season, growing rabbits utilize the feed which within their normal natural feeding system (Ojebiyi *et al.*,2015). The same authors added that the number of feeds during light period drops and the morning "feeding rest" tends to lengthen.

Table 2. Effect of feeding times on growth performance of New Zealand White growing rabbits.

Traits	Age (wks)	Treatment groups					SEM	P value
		C	T1	T2	T3	T4		
Body weight (g)	6	742.61	743.52	727.36	734.73	726.00	5.12	0.8736
	8	982.45	979.33	983.90	984.00	990.12	7.13	0.7925
	10	1275.82	1252.11	1258.00	1300.36	1280.03	9.75	0.6276
	12	1718.12 ^{ab}	1636.46^{b}	1650.00^{b}	1780.62 ^{a}	1766.85 ^{a}	10.82	0.0320
	14	2000.44 ^{ab}	1930.26 ^{b}	1940.50 ^{b}	2048.54 ^{a}	2036.00^{a}	11.25	0.0164
	16	2270.35 ^{b}	2152.78 ^{d}	2200.22 ^{c}	2370.80^{a}	2350.52 ^{a}	14.06	<.0001
Body weight gain (g/rabbit/day)	6-8	17.13	16.84	18.32	17.81	18.87	0.35	0.6852
	8-10	20.96	19.48	19.58	22.60	20.71	0.46	0.7931
	10 -12	31.59	27.45	28.00	34.30	34.77	0.49	0.6262
	12 - 14	20.17	20.99	20.75	19.14	19.23	0.53	0.1416
	14 - 16	19.28^{b}	15.89^{c}	18.55^{b}	23.02 ^{a}	22.47 ^{a}	0.56	0.0003
	6-16	**21.82** ^{ab}	**20.13**^{b}	**21.04**^{b}	**23.37** ^{a}	**23.21** ^{a}	0.17	<.0001
Feed intake (g/rabbit/day)	6-8	61.00	59.22	60.15	60.86	60.88	0.26	0.8453
	8-10	70.42	67.00	67.56	68.75	69.00	0.46	0.4213
	10 -12	93.26	89.06	90.11	91.54	91.82	0.56	0.3562
	12 - 14	102.32	99.89	100.34	101.36	101.13	0.64	0.7343
	14 – 16	110.00 ^{a}	103.30 ^{b}	104.71 ^{b}	108.42 ^{ab}	108.10 ^{ab}	0.60	0.0195
	6-16	**87.40**	**83.69**	**84.57**	**86.18**	**86.19**	0.43	0.7462
Feed conversion (g feed/g gain)	6-8	3.56	3.52	3.28	3.42	3.23	0.09	0.6524
	8-10	3.36	3.44	3.45	3.04	3.33	0.10	0.7423
	10 -12	2.95 ^{ab}	3.24 ^{a}	3.22 ^{a}	2.67 ^{b}	2.64 ^{b}	0.07	0.0340
	12 - 14	5.07	4.76	4.84	5.30	5.26	0.12	0.8441
	14 – 16	5.71 ^{ab}	6.50 ^{a}	5.64 ^{ab}	4.71 ^{b}	4.81 ^{b}	0.19	0.0226
	6-16	**4.00** ^{ab}	**4.16** ^{a}	**4.02** ^{ab}	**3.69** ^{b}	**3.71** ^{b}	0.04	0.0138

$^{a-d}$ Means within each row for each division with no common superscripts are significantly different (P≤0.05).

During the night, there is an elevation in activity, reduction in stress and boredom unlike the experience during the rest of the day. The reduction in feed intake is the main sign of heat exposure (Abdel-Monem *et al.*, 2007)

and such reduction in feed intake during the hottest intervals of the day may due to the environmental temperature, which stimulates peripheral thermal receptors to transmit suppressive nerve impulses to the appetite center in the hypothalamus resulting in a reduction in feed intake.

Restricting feeding times enhancing feed utilization (Dalle- Zotte *et al*., 2005). Ogbu *et al*. (2014) who found that rabbits consume the most of their feed during 03:00-06:00, 15:00-18:00 and 18:21 h. Bergaoui *et al*. (2008) showed that the diet was eaten through 16:00 h for an 85% FI and during 10:00 h for a 70% FC during summer season. Feeding time restriction to 7:00 h a day did not significantly affect growth performance of growing rabbits (Sena *et al*., 2012). Feeding growing rabbits for only 10 h a day decreased FI by 20%, while night feeding decreased FI by 10% and the daily gain to 5% (Sena *et al*., 2015). Osman (1991) and Tůmová *et al*. (2003) indicated that feeding growing rabbits 7:00 h per day did not impact body weight at marketing age. The current results are in agreement with those reported by Mahrose (2000), Bovera *et al*. (2008), Ojebiyi *et al*. (2015) and Farghly *et al*. (2017) who observed that BW of rabbits on night feeding exceeded those of the day feeding. However, Tůmová *et al*. (2003), Yakubu *et al*. (2007), Matics *et al*. (2012), Duperray *et al*. (2012) and Uhlířoval *et al*. (2015) observed non-significant changes in final body weight of growing rabbits due to feeding times.

2. Carcass characteristics:

Data presented in Table 3 indicated that the rabbits fed during 22:00 to 04:00 h (T3) showed significantly ($P<0.05$) the highest percentages of dressed carcass as compared with their counter parts. However, rabbits of the control group gave significantly ($P<0.05$) the lowest average of whole fat percentage in comparison with the other groups. Non-significant differences were found in the other carcass characteristics due to changing feeding time. Carcass characteristics are the most important elements to take into consideration when assessing alternative feeding programs (Tůmová *et al*., 2006).

Contradictory findings in results of carcass characteristics could be caused by different intensities and times of feed restriction or changing. The current results are in line with those observed by Tůmová *et al*. (2003), Yakubu *et al*. (2007), Duperray *et al*. (2012), Ojebiyi *et al*. (2015) and Sena *et al*. (2015) who indicated non-significant differences in carcass characteristics due to feeding times. On the other hand, Matics *et al*. (2012)

Table 3. Effect of feeding times on carcass traits of New Zealand White growing rabbits.

Traits	Treatment groups					SEM	P value
	C	T1	T2	T3	T4		
Heart, %	0.433	0.407	0.416	0.424	0.419	0.002	0.7265
Liver, %	4.92	3.81	3.90	4.65	4.45	0.058	0.1658
Kidney, %	0.745	0.688	0.711	0.732	0.694	0.092	0.4768
Whole fat,%	3.16 [a]	2.53 [b]	2.98 [ab]	3.03 [ab]	3.04 [ab]	0.091	0.0235
Dressed,%	58.71[ab]	57.12[b]	58.38[ab]	59.11[a]	58.62[ab]	0.523	0.0437

[a and b] Means within each row for each division with no common superscripts are significantly different (P≤0.05).

reported that rabbits fed *ad libitum* had significantly higher dressing percentage than those of the restricted groups.

3. Blood constituents:

Results of the effect of feeding times on blood constituents (Within normal range according to Stevin (1974)) are presented in Table 4. Rabbits of T3 group showed the lowest (P<0.05) values of A/G ratio and neutrophil/ lymphocytes (N/L) ratio when compared with their counterparts. Glucose concentration was high (P<0.05) in plasma of rabbits of the control group and those fed during 2200 to 0400 h (T3). Blood constituents in rabbits are as indicators of stress conditions and evaluation of the metabolic processes and the health status (Chodová *et al*., 2017). Diurnal and seasonal variations are among the most important factors affecting blood constituents (Çetin *et al*., 2009).Total plasma concentrations of protein, globulin and albumin are related to its metabolism and were within the normal physiological range mentioned by (Özkan *et al*., 2012). The present findings confirmed that restricting and changing feeding times did not impact the synthesis and transfer of plasma proteins and protein catabolism (Chodová *et al*., 2017).
Glucose concentrations significantly influenced by changing feeding times and that was in line with the findings of Rommers *et al*. (2004), while it was on contrary to what is reported by Van Harten and Cardoso (2010) and El-Speiy *et al*. (2015). Most of our results were not impacted by changing feeding times which corresponds with Mahrose (2000), Abdel-Monem *et al.* (2007), Mahrose *et al.* (2010), Chodová *et al.* (2017). The present findings disagree with those showed by Mahrose (2000), Attia(2004) and Azoz and El-Kholy (2006) who obtained significant differences in the present blood components due to season effects.

Table 4. Effect of feeding times on blood constituents of New Zealand White growing rabbits.

Traits	Treatment groups					SEM	P value
	C	T1	T2	T3	T4		
Total proteins (mg/dl)	7.33	6.85	6.91	7.14	7.19	0.09	0.7562
Globulin (mg/dl	3.15	2.76	2.85	3.11	3.10	0.06	0.8648
Albumin (mg/dl	4.18	4.09	4.06	4.03	4.09	0.04	0.3496
A:G ratio	1.33 [b]	1.48 [a]	1.42 [ab]	1.30 [b]	1.32 [b]	0.03	0.0324
Total lipids (g/dl)	3.13	2.88	2.92	3.04	3.02	0.05	0.6275
Glucose (mg/dl)	17.00 [a]	13.89 [b]	13.93 [b]	16.91 [a]	16.06[ab]	0.56	0.0426
AST U/I	31.71	32.78	31.32	29.81	30.63	0.89	0.4276
ALT U/I	18.11	18.55	18.39	16.79	17.00	0.41	0.2625
N / L Ratio	0.58[a]	0.59[a]	0.54[ab]	0.47 [c]	0.49[bc]	0.01	0.0026
Cortisol (ng/ml)	12.93	13.11	11.80	10.73	11.00	1.11	0.4283

[a and b] Means within each row for each division with no common superscripts are significantly different (P≤0.05).

*4. **Health aspects:***

Body temperature of rabbits fed during 22:00 to 04:00 h had the lowest temperature as compared with the other groups (Table 5). There were non-significant differences in morbidity, mortality and health risk percentages. Our strategy of changing feeding times improved the health aspects of rabbits under heat stress conditions compared to the *ad libitum* group. This suggests that under heat stress conditions, the restriction and changing feeding times that induce the improvement of health. The improvement in body temperature of rabbits fed during 22:00 to 04:00 h in the present study might be attributed to the improvement in environmental conditions during that time. During heat stress conditions, mortality rate (%) is the most obvious indicator (Bovera *et al*., 2008). Feed restriction has positive influence on the health status of growing rabbits after weaning (Chodová and Tůmová, 2013).

In that respect, Abdel-Monem *et al*. (2007) and Ojebiyi *et al*. (2015) showed that rectum temperature was insignificantly influenced by feeding times. Peter (1999) confirmed that at normal rectal temperature (comfort temperature); rabbits ingest approximately 200% as much water as feed.

This applies to the rabbits fed exclusively at the period of 22:00 to 04:00 h, but got only water during the rest of the day. The reduction in body

Table 5. Effect of feeding times on rectal temperature and healthy aspects of New Zealand White growing rabbits.

Traits	Treatment groups					SEM	P value
	C	T1	T2	T3	T4		
Rectal temperature (C°)	40.36[ab]	40.71[a]	40.29[ab]	39.53[b]	39.58[b]	0.08	0.0425
Morbidity, %	12.50	12.50	12.50	0.00	0.00	1.76	0.3562
Mortality, %	0.00	25.00	12.50	12.50	0.00	1.91	0.4892
Health risk, %	12.50	37.50	25.00	12.50	0.00	2.06	0.6396

[a and b] Means within each row for each division with no common superscripts are significantly different (P≤0.05).

temperature of rabbits fed during 22:00 to 04:00 h in comparison with the other rabbits may help in enhancing feed intake and body weight of those rabbits. However, Tůmová *et al.*, (2003), Bergaoui *et al*., (2008), Matics *et al*., (2012) and Duperray *et al*., (2012) concluded that feed restriction did not significantly affected mortality and health status of the growing rabbits. Bovera *et al*., (2008) found that mortality rate (%) was significantly higher for restricted group than the control one due to heat stress.

Conclusively, it could be concluded from the present results, that changing feeding time in growing rabbits during 22:00 to 04:00 h. Finally, feeding growing rabbits during 2200 to 0400 as recommended had beneficial impacts on their growth performance.

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تغيير وقت التغذية لتجنب التأثيرات الضارة للصيف الحار على أرانب النيوزلندي الأبيض

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هذه الدراسة اجريت لدراسة تأثير اوقات التغذية على الأداء الانتاجى لأرانب النيوزلندي الأبيض النامى فى صيف اسيوط الحار بصعيد مصر. حيث تم تربية اربعة وستون أرنبا عمر 6 أسابيع في أقفاص مقسمة إلي اربعة مجاميع (16 ارنب بكل مجموعة). المجموعة الأولى (مجموعة المقارنة) غذيت تغذية حرة، إما المعاملة الأولى فغذيت خلال الفترة من الساعة 1000 الى 1600. المعاملة الثانية فغذيت خلال الفترة من الساعة 1600 الى 2200. المعاملة الثالثة فغذيت خلال الفترة من الساعة 2200 الى 0400. المعاملة الرابعة فغذيت خلال الفترة من الساعة 0400 الى 2200. جميع الارانب ربيت تحت نفس الظروف البيئية و الرعائية خلال فترة التجربة.

أظهرت النتائج إنه تم ملاحظة وجود تأثيرات معنوية في وزن الجسم (عمر 12، 14 و16)، و الزيادة فى وزن الجسم (عمر 14-16 و 6-16 اسبوع)، و استهلاك الغذاء (عمر 14-16 اسبوع)، و الكفاء التحويلية (عمر 14-16 و 6-16 اسبوع). الارانب التى غذيت خلال الفترة من الساعة 2200 الى 0400 . اظهرت نسب ذبيحة عالية. بينما مجموعة الكنترول عرضت النسب الاقل للدهن الكلى مقارنة بالمجاميع الاخرى. لا يوجد اختلاف معنوية فى صفات الذبيحة الاخرى نتيجة لتغيير وقت التغذية. ارانب المجموعة الثالثة عرضت النسب الاقل لـ *A/G ratio* و *N/L ratio* مقارنة بالمجاميع الاخرى. تركيز الجلوكوز كان اعلى فى ارانب مجموعة الكنترول (المقارنة) والارانب التى غذيت خلال الفترة من الساعة 2200 الى 0400. حرارة جسم الارانب التى غذيت خلال الفترة من الساعة 2200 الى 0400 كانت الاقل مقارنة بالمجاميع الاخرى. بينما لا يوجد اختلافات واضحة في نسب النفوق و الحالة الصحية. نستخلص من النتائج الحالية إن تغيير وقت التغذية فى الارانب النامية غذيت خلال الفترة من الساعة 2200 الى 0400 كان ذو تأثيرات مفيد على ألاداء.

التوصية: انه من الموصى تغذية الارانب النامية خلال الفترة من الساعة 2200 الى 0400 فى المناطق الحارة.