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THE EFFECT OF BREEDS AND FEED RESTRICTION LEVEL ON SERUM BIOCHEMICAL RESPONSE OF RABBITS

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SUMMARY

The aim of this study was to estimate the rabbit' breed effect (Red Baladi (RB), and New Zealand White (NZW) breeds), fed ad libitum for the first 11weeks of age then were shifted to the restriction feed for two weeks starting at 11th and 12nd weeks of age, till 15thweek of age on body weight gain, mortality rate, and serum biochemical phenotypes. Rabbits were allocated into three groups; control, 60%, and 80% from ad libitum feeding to the restricted feed trial implement. Growth performance traits and serum biochemical indices were measured weekly.

During the feed restricted period, the body weight gain was negatively affected in restriction feed groups compared to the control group. However, the average weekly weight gain and feed intake or the feed conversion ratio (FCR) were affected ($P \leq 0.05$) by either feed restriction or breed over the entire experimental period. Mortality rate (%) was entirely zero for all studied groups. Although the feed restriction had reduced ($P \leq 0.05$) the total protein (g/dl), triglycerides, (mg/dl), LDL cholesterol (mg/dl) and ALT (U/L), AST (U/L) enzymes, but ALP (U/L) and total cholesterol (mg/dl) did not affect after two weeks of feeding. In conclusion, restriction feeding for growing rabbits starting from 11thweeks of age for two weeks is recommended to improve the serum biochemical indices and therefore the growth performance.

Keywords: feed restriction, growth performance and serum biochemical

INTRODUCTION

Rabbit meat is an important source of animal protein in Egypt, it provides source of protein while featuring low fat cholesterol content and high quality biological value (Aduku and Olukosi, 1990). Thus, if selected for high feed intake and growth rate, rabbits will provide delicacy and healthy food (Dallezotte, 2000) at reasonable price. Therefore, growing rabbits are usually fed *ad libitum* to achieve the highest performance of growth rate (Maertens, 2010). However, under certain circumvent areas, feed restriction is used post–weaning to avoid high daily changes in feed intake and the associated digestive disorders (Gidenne *et al*., 2012; Maertens and Gidenne, 2016) that lead to animal losses. Nevertheless, feed restriction is used also at different intervals at ages of the rabbit life at different levels (Di Meo *et al*., 2007). Though, feed restriction reducing the growth during the restriction interval, but the growth reduction can be compensated after feed restriction period (Govaerts *et al*., 2000), so that the high level of feed restriction has the same effect on final live body weight as lower level (Anderson *et al*., 2005). Furthermore, a positive effect on feed efficiency of restricted animals commenced growth was reported by Tumová *et al*. (2002); DalleZotte *et al*. (2005) and De Oliveira *et al*. (2012), where the feed conversion rate and digestive process for feed were improved (Tůmová *et al*.,2002; Di Meo *et al*., 2007 and Abdel-Wareth *et al*.,2015).Wherever, the compensatory growth depends on the interval and level of restriction (Di Meo *et al*., 2007; Gidenne *et al*., 2009a; Romero *et al*., 2010 and Abdel-Wareth *et al*., 2015). Feed restriction for a short period of time also changes the nutritional status of system and thus influence blood metabolites concentrations as reported by Renaville *et al*. (2000); Cabaraux *et al*. (2003); Guyton and Hall, (2006). Moreover blood characteristics in rabbits are used for infectious detecting stress conditions, and evaluating the metabolic condition of animals (Mohammadalipour *et al*., 2017). Biochemical blood parameters are influenced by a lot factors including breed (Martinec *et al*., 2012), and nutrition (Addass *et al*., 2012; Etim *et al*., 2014). Furthermore, Van Harten and Cardoso (2010), stated a low concentration of serum biochemical components after feed restriction interval. Therefore, the aim of the current study was to evaluate the effects of levels of feed restriction (0%, 60% and 80% from ad libitum intake) for two weeks on growth performance and serum biochemical parameters in Red Baladi and New Zealand white.

MATERIALS AND METHODS

The present experiment was carried out at the Rabbits Research Farm, Department of Animal Production, Faculty of Agriculture, Suez Canal University, Ismailia, Egypt during the period from September 2017 to February2018.

Experimental design and rabbit management:

A total of 156 rabbits (78 Red Baladi and 78 New Zealand White) were used in this study. Rabbits were weaned at an age of 28 day and were allocated into three groups; each of 26 rabbits. Animals were kept individually in galvanized wire batteries equipped with automatic nipple drinkers and separate feeders. Lighting system was sixteen hr light/eight hr dark in the rabbit during experimental period and apparently healthy and free of any external parasites or skin diseases.Pre-experiment was conducted to carry out the amount of *ad libitum* feed to calculate the feed restriction levels upon the total daily feed intake. The feed restriction started at 11thwk for two weeks (*ad libitum* 0%, 60%and 80% from *ad libitum* fed 125g). At the beginning of the 13thweek of age, treated groups were fed *ad libitum* continuously till the slaughter at15th weeks of age. The calculated chemical components of the diet were 18% crude protein, 2.69% fat, 12.39% crude fiber and 2738 kcal digestible energy/kg diet. The rabbits were fed according to NRC requirement (1984).

Performance and Serum biochemical parameters

Growth traits:

Rabbits were individually weighed weekly at fixed day early in the morning before feeding. Then the body weight gain, feed intake (g), FCR (kg feed/kg gain) and mortality rate was recoded.

European Efficiency factors (EEf) were calculated according to Nilipour, (1998):

EEF= (weight gain (g)/age day) × (viability rate %/ FCR (kg feed/kg gain):10.

Serum biochemical parameters:

Three blood samples were withdrawn from the ear vein of individual rabbits during 11th, 12th weeks and at the slaughter (15thweek of age). At the end of the experiment (15thweek of age), rabbits treatments within breed were individually weighted after 12h fasting slaughtered and bleed for 3-5 minutes,

Serum was separated by centrifugation of the blood samples at 3000 rpm for 15 minutes and stored at -20°C until analysis. Total protein, total cholesterol, triglycerides, LDL cholesterol, HDL cholesterol and liver enzymes activity (alanine aminotransferase (ALT),aspartate aminotransferase (AST) and aspartate aminotransferase (ALP) were calorimetrically determined using commercial kits (Reactivos GPL CHEMELEX, S.A Pol. Ind. Can Castells. C / Industria 113, Nau J 08420 Canovelles – Barcelona), as described by Young and Friedman, (2001).

Statistical analysis:

Data were statistically analyzed using General Linear Models Procedure of the SPSS 20 program (2011).

A 3x2 factorial design was used. The following model was used to study the effect of main factors and interaction between feed restriction levels (FR) and Breed (B) on parameters investigated as follows:

$Y_{ijk} = u + T_i + B_j + (TB)_{ij} + e_{ijk}$

Where:

Y_{ijk}=An observation on mention off analyzed traits u= overall mean ; T_i = effect of FR level; I = (1,2 and 3); B_j = effect of breed; $_j$=(1 and 2); $(TB)_{ij}$ = effect of interaction between FR and B ($_{ij}$ (1,2….6); and e_{jik}= Experimental error. The Differences means among treatments were subjected to Duncan´ s Multiple Range- test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth Performance:

Weight gain:

The effect of breed and feed restriction levels and their interaction effects on weight gain atthe 1stweek, 2nd weeks and after feed restriction period are presented in a Table (1). The feed restriction levels had negative effects (P≤ 0.05) on weight gain (g) in two weeks of feed restriction, but switched to positive effect (P≤ 0.05) after feed restriction period. There was also interaction effect between breed and the levels of feed restriction on weight gain (P≤0.05). At the beginning of the feed restriction period, the feed intake was reduced and backed to normal a*d-libitum* intake to compensate rabbits growth, which is in agreement with Birolo *et al*., (2017) and Tůmová *et al*. (2018).

Feed efficiency traits:

The feed intake was lower (P< 0.05) in the 60% restriction feeding group (FR1) than the *d-libitum* group (FR0) (P<0.05) but the total feed intake of rabbits was not significantly (P> 0.05) changed between the two breeds, which may be due to equality total feed intake among treatments. Moreover, FCR (kg feed/kg gain) and (EEf) were significantly lower (P< 0.05) in the (FR0) than in the (FR1) group (P<0.05), with no breed difference detected (P< 0.05) as shown in Table (2). The feed intake was similar for control and feed restricted groups, which might be related to feeding behavior contributes to the results of feed intake (Tumova *et al*., 2003); Romero *et al*., 2010; Gidenne *et al*., 2012). The improvement of FCR might be associated with the morphological and physiological changes in the intestine in the restricted rabbits, which had a longer small intestine (Oliveira *et al*., 2012) and a longer retention time. In contrary, Gidenne *et al*. (2009b) found that the compensatory growth was not linked with evolved feed conversion in which, where feed convers was increased in restricted feed groups compared to the *ad libitum* group.

The results revealed that the feed restriction had no significant effect on mortality rate (%) and similar results were reported by Foubert *et al*. (2008); Ebeid *et al*. (2012). While along restriction period for 2 or 3 weeks to decrease mortality rate and digestive problems (Gidenne *et al*., 2012). Morover,the duration of feed restriction had no influence on mortality percentage as reported by Gidenne *et al*. (2003); Yakubu *et al*. (2007).

Table 1. Effect of breed, feed restriction and their interaction on weight gain (g) of rabbits at different age out the experiment

Weeks	Breed		FR			Inter. Effects: B*FR					
	RB	NZW	FR0	FR1	FR2	RB*FR0	RB*FR1	RB*FR2	NZW*FR0	NZW*FR1	NZW*FR2
1stwk (FR)	97.1^{b}	105.1^{a}	200.1^{a}	72.^{4ab}	111.3^{b}	195.3^{a}	66.9^{ab}	80.1^{b}	203.2^{a}	70.0^{ab}	105.1^{b}
	±4.99	±5.01	±2.79	±3.89	±3.61	±5.82	±5.82	±5.82	±5.79	±5.79	±5.79
2ndwk (FR)	61.6^{b}	73.8^{a}	201.8^{a}	-7.92^{c}	9.3^{b}	201.3^{a}	-19.3^{c}	2.79^{b}	202.2^{a}	3.2^{c}	15.8^{b}
	±3.30	±3.30	±4.04	±4.10	±3.995	±5.74	±5.68	±5.74	±5.71	±.5.68	±5.71
After (FR)	328.8^{b}	332.4^{a}	200.0^{c}	404.6^{a}	387.3^{b}	201.1^{c}	404.1	381.2^{b}	198.9^{c}	405.1	393.5^{b}
	±3.96	±3.96	±4.85	±4.90	±4.80	±6.89	^{a}±6.82	±6.90	±6.86	^{a}±6.82	±6.86
Atslaughter	196.6^{b}	289.3^{a}	229.^{2ab}	249.9^{a}	249.2^{b}	170.8^{ab}	200.4	218.8	287.5^{b}	299.3	280.4^{ab}
	±6.03	±6.03	±7.38	±7.31	±7.46	±10.50	^{a}±10.39	^{b}±10.50	±10.44	^{a}±10.39	±10.44

First wk (FR): Frist week form feed restriction; 2ndwk (FR): two week form feed restriction RB: Red Baladi Breed; NZW: New Zealand White Breed; FR0: control diet; FR1:60% of the diet; FR2:80% of the Diet;B *FR: Interaction between breed and feed;±: standard error of the mean;a-b Means within the same row with the different superscript letter are significantly different (p >.05).

Table 2. Interaction effects on feed intake (g), feed conversion ratio (kg feed/kg gain) and economic efficiency factors at slaughter age

Traits	Inter. Effects: B*FR					
	RB*FR0	RB*FR1	RB*FR2	NZW*FR0	NZW*FR1	NZW*FR2
TFI	7175^{a}	6895^{b}	6615a^{b}	7175^{a}	6895^{b}	6615^{ab}
FCR	3.37^{a}	3.07^{b}	2.82^{ab}	3.04^{a}	2.82^{b}	2.88^{ab}
EEf	5.9^{ab}	6.7^{b}	7.3^{a}	7.2^{ab}	8.3^{a}	8.1^{b}

B*FR: Interaction between breed and feed; T.F.I: total feed intake (g) from (4) weeks to slaughter; FCR: Feed conversion ratio (kg feed/kg gain) at slaughter; (EEf):Economic Efficiency factor

Serum biochemical parameters:

The values of all serum biochemical characteristics in the current study were within the physiological range as described by Hewitt *et al*. (1989); Archetti *et al*. (2008). The effect of breed, feed restriction levels and their interaction effects on the total protein (g/dl),total cholesterol (mg/dl), triglycerides (mg/dl),LDL cholesterol (mg/dl) and HDL cholesterol (mg/dl), at 1stweek, 2ndweek and after feed restriction are shown in Tables (3 & 4). Breed, feed restriction and their interaction affects ($P<0.05$) at the 1stweek, 2nd week and after feed restriction reduced serum total protein. Feed restriction had reduced ($P\leq 0.05$) total protein as stated with Rajman *et al*. (2006); Van Harten and Cardoso (2010); El-Speiy *et al*. (2015), where Archetti *et al*. (2008) and Özkan *et al*., (2012) explain that the concentrations of total protein are related to protein metabolism. The total cholesterol (mg/dl) had no effect ($P\leq 0.05$) after 2nd week by feed restriction, but it had reduced ($P\leq 0.05$)at slaughter time, which in agreement with Beshara *et al*. (2017).In contrast, El-Speiy *et al*. (2015) showed that total cholesterol concentration increased at the end of the rabbits treated with feed restriction. The triglycerides (mg/dl) was significantly ($P\leq 0.05$) reduced due to feed restriction, which was in agreement with Van Harten and Cardoso, (2010) and El-Speiy *et al*. (2015). In connection with the feed restriction had positive effect ($P\leq 0.05$) on LDL and HDL cholesterol (mg/dl) identical to Van Harten and Cardoso, (2010); Fatma and Hayam, (2014) and Darina *et al*. (2018).

Table 3. Effect of breed, feed restriction and their interaction on total protein (g/dl) and total cholesterol (mg/dl)

Traits	Breed		FR			Inter. Effects: B*FR					
	RB	NZW	FR0	FR1	FR2	RB*FR0	RB*FR1	RB*FR2	NZW*FR0	NZW*FR1	NZW*FR2
						Total protein(g/dl)					
11th week	6.02^{a}	5.43^{b}	5.69^{b}	5.85^{a}	5.64^{ab}	6.01^{b}	6.21^{a}	5.85^{ab}	5.36^{ab}	5.49^{a}	5.42^{b}
(FR)	±0.028	±0.091	±0.058	±0.054	±0.029	±0.04	±0.048	±0.044	±0.052	±0.028	±0.031
12th week	5.77^{a}	5.36^{b}	5.93^{a}	5.32^{ab}	5.44^{b}	6.24^{a}	5.51^{b}	5.55^{b}	5.63^{a}	5.13^{ab}	5.34^{b}
(FR)	±0.046	±0.035	±0.052	±0.034	±0.042	±0.043	±0.042	±0.041	±0.036	±0.072	±0.078
Atslaughter	6.16^{a}	5.83^{b}	6.28^{a}	5.87^{b}	5.83^{ab}	6.60^{a}	5.96^{b}	5.91^{b}	5.96	5.77^{b}	5.76^{b}
	±0.042	±0.037	±0.054	±0.039	±0.041	±0.054	±0.034	±0.039	^{a}±0.029	±0.021	±0.076
						Total cholesterol(mg/dl)					
11th week	84.13^{a}	82.99^{b}	82.02^{ab}	84.67^{a}	83.98^{b}	82.29^{a}	85.96^{a}	84.13^{a}	81.75^{a}	83.44^{a}	83.83^{a}
(FR)	±0.258	±0.258	±0.316	±0.313	±0.320	±0.450	±0.445	±0.450	±0.447	±0.445	±0.447
12th week	83.61^{a}	82.20^{b}	82.92^{a}	82.71^{a}	83.09^{a}	83.29^{a}	84.08^{a}	83.46^{a}	82.54^{a}	81.36^{a}	82.74^{a}
(FR)	±0.55	±0.55	±0.313	±0.309	±0.316	±0.444	±0.444	±0.440	±0.442	±0.442	±0.440
Atslaughter	83.26^{a}	82.35^{b}	84.29^{a}	82.34^{b}	81.79^{ab}	86.63^{a}	83.42^{b}	79.75^{ab}	81.96^{b}	81.28^{ab}	83.96^{a}
	±0.343	±0.343	±0.420	±0.416	±0.425	±0.597	±0.591	±0.594	±0.597	±0.591	±0.594

First wk (FR): First week form feed restriction; 2ndwk (FR): two week form feed restriction; RB: Red Baladi Breed; NZW: New Zealand White Breed; FR0: control diet; FR1:60% of the diet; FR2:80% of the Diet; B *FR: Interaction between breed and feed;±: standard error of the mean; a-b Means within the same row with the different superscript letter are significantly different (p >.05).

Table 4. Effect of breed, feed restriction and their interaction on triglycerides, LDL cholesterol and HDL cholesterol

Traits	Breed		FR			Inter. Effects: B*FR					
	RB	NZW	FR0	FR1	FR2	RB*FR0	RB*FR1	RB*FR2	NZW*FR0	NZW*FR1	NZW*FR2
						Triglycerides(mg/dl)					
11th week (FR)	85.22^{a} ±0.217	74.49^{b} ±0.217	79.79^{a} ±0.266	80.02^{a} ±0.263	79.74^{a} ±0.268	84.79^{a} ±0.378	85.96^{a} ±0.378	84.92^{a} ±0.374	74.79^{a} ±0.376	74.32^{a} ±0.376	74.35^{a} ±0.374
12th week (FR)	85.08^{a} ±0.287	71.72^{b} ±0.287	80.04^{a} ±0.352	76.59^{ab} ±0.348	78.62^{b} ±0.355	85.42^{a} ±0.500	85.42^{a} ±0.495	84.42^{b} ±0.500	74.67^{a} ±0.495	68.12^{ab} ±0.489	72.57^{b} ±0.498
At slaughter	85.43^{a} ±0.266	71.36^{b} ±0.266	80.13^{a} ±0.335	76.59^{ab} ±0.329	78.51^{b} ±0.322	86.46^{a} ±0.463	85.42 ^{b}±0.485	84.42^{ab} ±0.463	73.79^{a} ±0.460	68.12^{ab} ±0.458	72.35^{b} ±0.460
						LDL cholesterol(mg/dl)					
11th week (FR)	32.58^{a} ±0.149	32.83^{a} ±0.149	31.81^{ab} ±0.182	33.41^{a} ±0.181	32.89^{b} ±0.184	31.33^{a} ±0.259	33.67^{a} ±0.257	32.75^{a} ±0.259	32.29^{a} ±0.258	33.16^{a} ±0.257	33.04^{a} ±0.258
12th week (FR)	29.40^{a} ±0.150	29.98^{a} ±0.150	31.85^{a} ±0.184	28.19^{ab} ±0.182	29.02^{b} ±0.186	31.33^{a} ±0.261	28.42^{ab} ±0.260	28.46^{b} ±0.258	32.38^{a} ±0.260	28.00^{ab} ±0.260	29.61^{b} ±0.258
At slaughter	27.57^{b} ±0.212	28.43^{a} ±0.212	32.19^{a} ±0.260	25.48^{ab} ±0.257	26.33^{b} ±0.262	31.96^{a} ±0.369	26.04^{b} ±0.365	24.71^{ab} ±0.369	32.42^{a}±0.367	24.96^{ab} ±0.365	28.00^{b} ±0.367
						HDL cholesterol(mg/dl)					
11th week (FR)	33.55^{b} ±0.151	34.87 ^{a}±0.151	33.58^{ab} ±0.185	34.76 ^{a}±0.183	34.29^{b} ±0.183	32.96 ^{a}±0.263	34.00 ^{a}±0.260	33.71 ^{a}±0.263	34.21 ^{a}±0.263	35.52^{a} ±0.261	34.87^{a} ±0.260
12th week (FR)	35.83^{b} ±0.166	37.37 ^{a}±0.166	34.71^{ab} ±0.204	38.21 ^{a}±0.202	36.89^{b} ±0.206	34.17^{ab} ±0.289	36.79 ^{a}±0.286	36.54^{b} ±0.288	35.25^{ab} ±0.288	39.60^{a} ±0.286	37.22^{b} ±0.288
At slaughter	37.78^{b} ±0.222	39.75^{a} ±0.222	35.65^{ab} ±0.272	41.75^{a} ±0.270	38.89^{b} ±0.275	35.08^{a} ±0.387	40.71^{a} ±0.383	37.54^{a} ±0.387	36.21^{a} ±0.385	42.80^{a} ±0.385	40.26^{a} ±0.383

First wk (FR): First week form feed restriction; 2ndwk (FR): two week form feed restriction RB: Red Baladi Breed; NZW: New Zealand White Breed; FR0: control diet; FR1:60% of the diet; FR2:80% of the Diet;B *FR: Interaction between breed and feed;±: standard error of the mean; a-b Means within the same row with the different superscript letter are significantly different (p >.05).

Table 5. Effect of breed, feed restriction and their interaction on ALT,AST and ALP (U/L)enzymes

Traits	Breed		FR			Inter. Effects: B*FR					
	RB	NZW	FR0	FR1	FR2	RB*FR0	RB*FR1	RB*FR2	NZW*FR0	NZW*FR1	NZW*FR2
						ALT(U/L)					
11th week (FR)	46.13^{a} ±0.124	42.57^{b} ±0.124	44.06^{a} ±0.152	44.59^{a} ±0.150	44.39 ^{a}±0.153	45.67^{a} ±0.216	46.38 ^{a}±0.213	46.33 ^{a}±0.216	42.46^{a} ±0.213	42.80 ^{a}±0.213	42.43^{a} ±0.215
12th week (FR)	44.44 ^{a}±0.220	39.60^{b} ±0.220	45.67 ^{a}±0.269	39.51^{ab} ±0.267	40.89^{b} ±0.272	46.46^{a} ±0.383	43.08^{ab} ±0.379	43.79^{b} ±0.383	44.87^{a} ±0.381	36.00^{ab} ±0.379	37.96^{b} ±0.381
At slaughter	47.36^{a} ±0.235	42.83^{b} ±0.235	47.35^{a} ±0.288	43.68^{ab} ±0.285	44.29^{b} ±0.291	47.96^{a} ±0.410	46.50^{ab} ±0.406	47.62^{b} ±0.410	46.75^{a} ±0.408	40.88^{ab} ±0.406	40.91^{b} ±0.408
						AST(U/L)					
11th week (FR)	37.06^{b} ±0.126	41.12 ^{a}±0.126	38.98 ^{a}±0.154	39.26 ^{a}±0.152	39.02 ^{a}±0.156	37.37^{a} ±0.219	36.46^{ab} ±0.217	37.33^{b} ±0.219	40.58^{ab} ±0.218	42.04^{a} ±0.217	40.70^{b} ±0.218
12th week (FR)	35.08^{b} ±0.162	37.83 ^{a}±0.162	39.42^{a} ±0.198	33.63^{ab} ±0.196	36.33^{b} ±0.200	38.25 ^{a}±0.281	32.67^{ab} ±0.278	34.33^{b} ±0.278	40.58^{a} ±0.280	34.60^{ab} ±0.281	38.35^{b} ±0.278
At slaughter	37.78^{b} ±0.279	43.85^{a} ±0.279	40.63^{b} ±0.342	41.55^{a} ±0.339	40.28^{ab} ±0.346	39.83^{a}± 0.486	35.79^{ab} ±0.481	37.71^{b} ±0.486	41.42^{ab} ±0.484	47.20^{a} ±0.481	42.83^{b} ±0.484
						ALP (U/L)					
11th week (FR)	74.92^{b} ±0.232	82.23 ^{a}±0.232	78.27 ^{a}±0.284	78.43 ^{a}±0.281	79.05 ^{a}±0.287	74.96^{a} ±0.404	74.58 ^{a}±0.400	75.21 ^{a}±0.404	81.58^{a} ±0.402	82.24^{a} ±0.400	82.87 ^{a}±0.402
12th week (FR)	72.07^{b} ±0.245	79.75 ^{a}±0.245	78.69^{a} ±0.300	73.15^{ab} ±0.297	75.89^{b} ±0.303	74.96 ^{a}±0.426	69.63 ^{a}±0.421	71.63 ^{a}±0.426	82.42^{a} ±0.424	76.68^{a} ±0.421	80.17 ^{a}±0.424
At slaughter	76.58^{b} ±0.220	83.25^{a}± 0.220	80.06^{a} ±0.269	79.57^{a} ±0.272	80.13^{a}± 0.269	75.96^{b} ±0.383	76.92^{a} ±0.379	76.88^{ab} ±0.383	84.17^{a} ±0.381	82.12^{ab} ±0.379	83.52^{b} ±0.381

First wk (FR):First week form feed restriction; 2^{n}wk (FR):two week form feed restriction RB: Red Baladi Breed; NZW: New Zealand White Breed; FR0: control diet; FR1: 60% of the diet; FR2: 80% of the Diet; B *FR: Interaction between breed and feed; ±: standard error of the mean; a-b Means within the same row with the different superscript letter are significantly different (P>.05), ALT; Alanine aminotransferase, AST; Aspartate aminotransferase and ALP Alkaline phosphat

The effect of breed, feed restriction levels and interaction effects between breed and feeding on alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) (U/L) enzymes in first week, 2nd week and after feed restriction in table (5).The feed restriction had reduced significantly (P≤0.05) ALT and AST at slaughter time, which is inconsistent with Gallois *et al*. (2005); Fatma and Hayam, (2014); Beshara *et al*. (2017) and Darina *et al*., 2018). In contrast, Amber *et al*. (2014) and Beshara *et al*. (2017) reported that the feed restriction did not significantly affect the ALT, AST and ALP.

CONCLUSIONS

Rabbits to feed restriction for two weeks stared in 11thwk compared with rabbits fed *ad libitum* up to slaughter time hadn't negative effect on growth performance, mortality and serum biochemical parameters. So, it is interesting to note that feed restriction will reduce feed costs of rabbits.

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تأثير السلالة وتحديد كمية العلف على الإستجابة الكيموحيوية في سيرم الأرانب

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تهدف هذه الدراسة إلى تقييم تأثير كلاً من سلالة الأرانب (سلالة البلدى الأحمر وسلالة النيوزلاندى الأبيض) وكمية العلف وذلك عند تحويل نظام التغذية من نظام يتغذى به الحيوانات بشكل حر إلى نظام يحدد فيه كمية العلف المقدمة للحيوان وذلك لمدة أسبوعين إبتداءاً من الأسبوع الحادى عشر والأثنى عشر وحتى عمر التسويق فى الأسبوع الخامس عشر من العمر وتأثير ذلك على معدل النمو ونسبه النفوق وبعض صفات الدم الكيموحيوية. قسمت الأرانب إلى ثلاث مجموعات تجريبية: المجموعة الأولى هي المجموعة الكنترول , المجموعة الثانية والثالثة تم تحديد كمية العلف في الأسبوع الحادي عشر والثاني عشر فقط بنسبة ٦٠٪ و ٨٠٪ من كمية العلف المغذى عليها المجموعة الكنترول علي الترتيب ولقد تم قياس الصفات الخاصة بالنمو والمؤشرات الكيميوحيوية في الدم أسبوعياً.

أوضحت النتائج أن تحديد كمية العلف أثرت بشكل سلبى على معدل زيادة الوزن الأسبوعية فى المجاميع التى تم فيها تحديد العلف مقارنة بمجموعة الكنترول وذلك فى أثناء فترة تحديد كمية العلف. بينما تأثر كلاً من معدل الزيادة الأسبوعية وكمية العلف المستهلك وكفاءة التحويل الغذائى فى نهاية فترة التجربة. كانت نسبة النفوق فى جميع مجاميع التجربة تساوى صفر وعلى الرغم من أن تحديد كمية العلف أدى إلى إنخفاض فى كلاً من البروتين الكلى ، الدهون الثلاثية والكوليسترول منخفض الكثافة وإنزيمات الكبد إلا أنه لم يؤثر على كلاً من الكوليسترول الكلى وانزيم الألكانيل فوسفاتيز وذلك بعد أسبوعين من تحديد كمية العلف.

نستنتج من نتائج هذه الدراسة أن تحديد كمية العلف إبتدءاً من الأسبوع الحادى عشر ولمدة أسبوعين أدت إلي تحسين أداء الأرانب وصفات الدم الكيموحيوية.