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GROWTH PERFORMANCE AND SOME PHYSIOLOGICAL RESPONSES OF NZW AND V-LINE WEANLING RABBITS PRODUCED FROM LOW-PRODUCER RABBIT DOES ADMINISTERED WITH HERBANA UNDER HEAT STRESS CONDITIONS

El-Hammady[1] H.Y., Anas A. Salem[2], and A.A. Abuoghaba[3,*]

[1] Dep. of Poul. Prod., Fac. of Agric., Assiut Uni., Assiut, Egypt.

[2] Dep. of Anim. Prod., Fac. of Agric., Assiut Uni., Assiut, Egypt.

[3] Dep. of Poul. Prod., Fac. of Agric., Sohag Uni., Sohag, Egypt.

Corresponding Author: Ahmed Abdelkareem Abuoghaba.Email:Abuoghaba@yahoo.com

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ABSTRACT: This experiment aimed to investigate the impact of Herbana administration on low-producer rabbit does during the last two weeks of pregnancy and the first two weeks after kindling on the growth performance and some physiological responses of their weanling rabbit kids.

Forty-eight, 4 weeks old, female weanling NZW and V-line rabbit kids were equally divided into three experimental groups (16 kids each, 8 NZW+ 8 V-line). In the first group (Gr1-control), weanling rabbit kids produced from low-producer rabbit does (2-3 weanling kids/doe/parity), while those in the second group (Gr2) were produced from normal rabbit does (4-5 weanling kids/doe/parity). In the third group (Gr3), weanling kids were produced from does daily treated with 1.0g /doe of the Herbana.

The achieved results showed significant breed differences in body weight (BW; $P \leq 0.001$) at different ages as well as in the daily feed intake (DFI) during 4-6 and 8-10 weeks of age. The means of feed conversion ratio (FCR) was significantly affected only at 4-6 weeks of age. Exposing female weanling NZW rabbits to heat stress significantly ($P<0.05$) decreased total protein (TP), albumin (Alb), globulin (Glb) and tri-iodothyronine hormone concentration (T3), while the mean of triglycerides (TG) significantly ($P<0.05$) increased than those of the V-line. Similarly, the means of rectal temperature (RT), respiration rate (RR) and ear temperature (ET) for V-line kids were significantly ($P \leq 0.01$) increased than those in NZW. Referring to Herbana administration, the means of BW, DFI, TP, Alb, T3 and thyroxin (T4) hormones increased significantly ($P \leq 0.05$) in the treated group, while the means of glucose (Glu), TG and total cholesterol (TC) were significantly decreased than those in the control group (Gr1). Similarly, the means of RT, RR, skin temperature (ST) and ET for rabbits in Gr3 were significantly ($P \leq 0.01$) decreased than those in the control group (Gr1).In general, it could be concluded that the DWG and DFI and physiological responses of NZW and V-line rabbits produced from low-producer rabbit does administered with Herbana significantly improved under heat stress conditions prevalent in Upper Egypt.

Keywords: Weanling rabbits, Herbana,Growth, Blood,Physiological responses, Heat stress.

INTRODUCTION

In Egypt, the high ambient temperature during summer season causes economical losses in the rabbit industry through its adverse effects on appetite and feed intake, live weight gain, feed efficiency, viability and mortality rate of rabbits (Marai et al., 2001 and El-Hammady et al., 2010). The herbal seeds has been successfully used as antibiotic substitutes for rabbits and poultry feeds, through inhibiting the harmful effects of fungal (Soliman and Badeaa, 2002) and the adverse affects of bacteria (Sağdiç and Özcan, 2003) as well as increasing secretion of pancreatic and intestinal enzymes (Costa et al., 2011a).

Several herbs and spices are assumed to have beneficial effects on the body weight of rabbits (El-Manylawi and Ali 2009) through improving both of morphological and histological modifications of the gastrointestinal tract (Utiyama et al. 2006) as well as digestive and absorptive efficacy of nutrients (Oetting et al. 2006a). In addition, the use of antibiotics and hormones may cause unfavorable side effects. Moreover, there are some evidences, indicating that these chemical products are considered as pollutants for human, which threaten their health on the long-run (Kustos et al. 2004). Therefore, the use some of the natural products such as medical plants could be widely accepted as promoter for improving the efficiency of feed utilization and consequently the animal productive and reproductive performance (El-Hammady and Abdel-Kareem 2015).

It is well known that dried fenugreek seeds are rich in total carbohydrates, fat, protein and minerals as calcium, phosphorus, iron, zinc and magnesium (Gupta et al. 1996). They also contain active constituents as alkaloids, flavonoids, steroids, saponins (Moradi kor et al. 2013) and phenolic and flavonoid compounds which help to enhance the antioxidant capacity (Zeweil et al. 2015). Through their efficient properties of hypocholesterolemic and hypoglycemic, anti-inflammatoric (Ahmadiani et al. 2001), antioxidant and antipyretic (Costa et al. 2007), as well as their stimulating activities for pancreatic enzymes and bile acid secretion (Platel et al. 2002), the treatment of poultry and rabbits with the herbal seeds has a significant improving effects on their productive and reproductive performance on economical basis.

It is known that the fennel seeds are rich in volatile oils and some essential minerals such as sodium, potassium, and sulfur (Rosti et al. 1994). The findings of Benlemlih et al. (2014) revealed that rabbits administered with fennel and/or thyme increased the feed intake and body weight during the first week of the treatment.

The caraway seeds contain large amounts of vitamin B complex, potassium, calcium, magnesium, silicon, zinc, iodine, copper, iron, and cobalt, which play an important role in relieving muscle cramps of smooth muscles in the gastrointestinal tract (Thakur et al. 2009). Similarly, the findings of De Martino et al. (2009) indicated that caraway oil, and plays important role in antioxidant activity due to their contents of monoterpene linalool, alcohols, anethole, carvacrol as well as estradiol, flavonoids and other polyphenolic compounds.

This study was conducted to evaluate the growth performance, blood parameters and some physiological responses of NZW and V-line weanling rabbit kids produced by low and normal as well as low-producer rabbit does administrated with the tested herbal seeds (Herbana).

MATERIALS AND METHODS

This study was conducted at the rabbit Farm, Department of Poultry Production, Faculty of Agriculture, Assiut University, Egypt. It lasted 8 weeks from Jun to July, 2013.

Experimental animals and management: Forty-eight female weanling rabbit kids (24 NZW and 24 V-line), 4 weeks old, were taken from the progenies of low, normal and low-treated rabbit does, which produced from the same parity. All weanling rabbits were classified into three equal groups; each included 8 NZW and 8 V-line. The weanling rabbits in the 1st group (Gr1) were taken from parent female rabbits, having an average of 2-3 weaned kids per parity (control). While those in the 2nd group (Gr2) were taken from females having number (4-5 weaned kids) i.e. the normal producer rabbit does. The weanling rabbit kids in the 3rd group (Gr3), were taken from the low producer parent does daily orally administered with 1.0g dried herbal seeds (Herbana) per rabbit doe in pelleted form during two weeks before kindling and two weeks after kindling.

All weanling rabbits were maintained in wire galvanized battery cages (50L×50W× 40H) and daily exposed to 16 continuous lighting hours. They were fed, ad-libitum on a basal grower commercial diet including 17.0% crude protein, 12.5% crude fiber, 2.99% fat, 0.6 % minerals mixture and 2500 K cal/kg digestible energy according to NRC (1977). Fresh tap water was available all the time. They were housed under the same managerial conditions. The dried herbal seeds consisted of 50% fenugreek and 30% caraway as well as 10% of both fennel and dill. The chemical composition of dried herbal seeds (Herbana) is 18.2% crude protein, 13.0% crude fiber, 3.2 % fat and 2746.2 Kcal/kg DE) according El-Hammady and Abdel-Kareem, (2014).

Preparation of the herbal dried seeds (Herbana): To prepare dried herbal seeds (Herbana), adequate quantities of the same components with the same percentages of the combined herbal seeds present in the Herbana capsules were mixed with 1.0% starch liquid as adhesive material minced and cut into small pieces, each of 1.0g after warm air dried.

Studied traits

1- Micrclimatic conditions:

The ambient temperature (AT/^{o}C) and relative humidity (RH/%) in the rabbit Farm, were daily recorded at 8:00AM and 2:00PM by using electronic digital thermo-hygrometer (Table 1). The temperature humidity index (THI) was calculated according to the equation of Marai et al., (2001) as follows: THI = db ^{o}C- [(0.31-0.31×RH) × (db^{o}C-14.4)] Where, db ^{o}C = dry bulb temperature and RH = Relative humidity (%)/100. The THI values were classified into: <27.8 (absence of heat stress), 27.8-28.8 (moderate heat stress), 28.9-29.9 (severe heat stress) as well as >30.0 (very severe heat stress).

2- Growth performance:

Weanling rabbits were biweekly weighed on an individual basis at 4th, 6th, 8th, 10th and 12th weeks of age. The Daily body weight gain was calculated during the periods of 4-6, 6-8, 8-10 and 10-12 weeks of age. The daily feed intake (FI) as well as feed conversion ratio (FCR) were recorded and calculated during the same periods.

3- Physiological responses:

3-1- Metabolic profile:

At 8th week of age, 48 blood samples were collected at 10.00AM from the marginal ear vein per each rabbit in dry clean centrifuge tubes. Thereafter, blood serum was separated by centrifugation at 3000 rpm for 15 minutes and kept at -20˚C in a deep freezer until analysis. Commercial kits (Diamond Diagnostic, Egypt) were used to determine the concentrations of total protein (TP), albumin (Alb), total lipids (TL), triglycerides (TG) and total cholesterol (TC) and glucose (Glu). While, the globulin values were determined by subtracting the Alb values from the corresponding TP values.

3-2- Liver functions:

The aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were measured by using methods described by Reitman and Frankel (1957).

3-3- Hormonal profile:
The concentrations of the thyroid hormones (T3 and T4) were determined by Elias method by using coated-tube kits, Diagnostic Products Corporation, Los Angeles, USA.

3-4- Thermoregulatory responses:
Thirty rabbits (15 NZW & 15 V-line) i.e. 5 rabbits each breed were chosen to measure weekly the physiological responses throughout the experimental period. Rectal temperature (RT/ºC) was measured by using a digital thermometer inserted into the rectum at depth of 2.0 cm for one minute. Skin and Ear temperatures (ST& ET/ºC) were measured by using a digital thermometer. The respiration rate (resp./ min) was measured by counting the flank movements by using a stopwatch for one minute. All physiological response measurements were done for the same tested rabbits as they were sitting quietly and breathing regularly.

Statistical analysis:
The obtained data were analyzed by the least square analysis of variance using the GLM procedure of the statistical analysis model (SAS, 1998) as follows: $Yij = \mu + B_i + T_j + B_iT_j + e_{ij}$ Where: Y_{ij}= The individual observation, μ= Overall mean, B_i= Effect of breed (NZW vs. V-line), Tj= Effect of treatment (rabbits taken from low producer parent females (Gr2) and treated with Herbana (Gr3) vs. the low producer group without Herbana treatment (Gr1), BTij= the fixed interacting effect between breed and treatment; Eij=Random error component assumed to be normally distributed. Duncan's new multiple ranges tests (Duncan, 1955) were used to determine the significant differences between treatment means.

RESULTS AND DISCUSSIONS

1- Microclimatic conditions:
From data presented in Table 1, it could be noticed that the means of interior THI (units) during the 1st, 2nd and 3rd weeks of the experiment were more adequate for raising rabbits, while the mean of THI (units) in the 4th week increased remarkably to reach moderate heat stress. The corresponding values during the 5th, 6th, 7th and 8th weeks of experiment increased to reach very severe heat stress, which adversely affected the productive performance.

2- Growth performance:
As shown in Table 2, the means of body weight in V-line rabbits were significantly increased than those of the NZW. These differences could be attributed to the genetical differences, which affect both of a number of weanling rabbit kids per parity and their body weights. These results are in agreement with those of Meshreky et al. (2005) who found that V-Line rabbits had higher values of growth traits at different experimental periods than the corresponding values of the Baladi Red and their crosses. Also, the results of El-Bayomi et al. (2012) showed significant differences among different weanling rabbit genotypes in body weight at weaning and post-weaning.

Regarding the treatment of Herbana, the means of BW and DFI increased significantly ($P \leq 0.05$) for weanling rabbits produced from parents, which have received dried herbal seed pellets (Gr3) than those of the Gr1 and Gr2, respectively. Newly weanling rabbits in Gr3 recorded 6.5 % higher ($P \leq 0.001$) in final BW than that of the untreated in Gr1, while the DWG was insignificantly increased. It has to be mentioned that DFI of kids in the Gr3 was significantly ($P \leq 0.05$) increased during the different growth periods by about 6.5, 4.4, 5.8 and 3.8% as compared to Gr1, while the FCR was insignificantly affected. The improvement of body weight and feed intake of weanling rabbits in Gr3 may be attributed to the active compounds as antibacterial, anti-inflammatory, antifungal , carminative and antioxidant activities in the tested herbal seeds. Also, the significant decrease in the BW and DFI could be attributed to the adverse effects of

the heat stress, which depressed the appetite and decreased the feed consumption and consequently the available nutrition's needed for optimal growth. These results agree with those of Hanna et al. (2008) who found that the live body weight of growing NZW weanling kids were higher (P≤0.05) in the groups treated with fennel, caraway seeds diets than that of the control group.

Also, the improved daily feed intake of the weanling rabbits in Gr3 may be attributed to the potent effects of the herbal seeds, since these promoters can stimulate the appetite and excite the olfactory nerves and taste buds of the female rabbits, which lead to increased feed consumption. This obtained improvement could be also attributed to the positive effects of herbal seeds, which stimulate the adhesion of pathogens as well as contributes to the favorable microbiota stabilization, which protects the intestinal villi and, consequently improves the digestion and absorption of nutrients (Hanczakowska and Swiatkiewicz 2012). These results agree with those of Zeweil et al. (2015) who reported that the averages of final BW and FI were significantly (P≤0.01) increased for V-line rabbits treated with fenugreek and anise seeds as compared to the control group. The achieved results in the persistency showed no interaction between breed and the herbal seeds treatment in BW, DWG, DFI and FCR.

3- Physiological responses:

3-1- Metabolic profile:

The obtained findings showed that the means of TP, Alb, Glb and TG for V-line rabbits significantly increased (P≤0.05) than their corresponding values of the NZW rabbits (Table 4). This improvement could be attributed to the increased hepatic functions of V-line rabbits than those of NZW. These results also agree with Azoz and El-Kholy (2005), who revealed that V-Line dams had higher significant (P≤0.05) values of total protein as compared to those of Bauscat rabbits. Similarly, the change in albumin level reflected the change in the liver functions. Also, Safaa et al. (2008) stated that the Black Baladi rabbits had higher values of plasma total protein and albumin than those of NZW. Similar results were also found by Abdel-Hamid and Farahat (2015), who found highly significant breed differences (P≤0.01) in total protein, albumin, and globulin. In contrast, the authors found no effect (P>0.05) due to breed on triglyceride levels.

Regarding the effect of treatment with herbal seeds, the means of TP, Alb, T3 and T4 hormone concentrations for weanling rabbits in Gr3 increased significantly (P≤0.05) than those in Gr1 and Gr2. The increased total protein could be attributed to the effect of the genetical constituents, which have important diagnostic significance through the protein's contribution and the involvement of the enzymes, hormones and antibodies as well as in keeping the osmotic pressure balance, maintaining the acid-base balance, and the nutritional reserve source for the body's tissues and muscles. These findings agree with those of Ibrahim et al., (2000), who found that the TP of NZW rabbit treated with 200g fenugreek green forage exceeded significantly that of the control group.

The obtained results in the current study indicated that the means of glucose, triglycerides and total cholesterol for weanling rabbits in Gr3 decreased significantly than those of rabbits in Gr1. This could be attributed to the global effects of the essential oils, leading to decrease in the activity of hepatic 3-hydroxu-3-methylglutaryl coenzyme A (HMG-CoA), which is a key regulatory enzyme in cholesterol synthesis. The decreased glucose level in Gr3 may be attributed to the increased glucose utilization through increasing both of catabolic and anabolic enzyme secretions and subsequently improving the metabolic rate. The decreased TC for weanling rabbits in Gr3 could be attributed to the

hypocholesterolemic effect of the herbal seeds, which contain active saponins, hemicelluloses, mucilage, tannin and pectin which help in lowering blood cholesterol levels by inhibiting bile salts. These results are in agreement with those of Moosa et al. (2006), who stated that fenugreek seed powder significantly decreased the serum triglycerides and LDL-cholesterol, while serum HDL-cholesterol level was not affected. These findings showed no significant differences in total lipids for weanling kids in all experimental groups. The achieved findings showed no significant differences in blood proteins, glucose, TG and TC due to the effect of interaction between breed and Herbana treatment.

3-2- Liver functions:

The obtained results showed insignificant increase of V-line for both AST (26.64 U/L) and ALT (17.91 U/L) activities than those in the NZW rabbits. Referring to Herbana treatment, the serum AST and ALT were insignificantly affected by Herbana administration. These results agree with those of Zeweil et al. (2015), who reported that the means serum ALT and AST in growing V-line weanling rabbits were insignificantly affected by the treatment with fenugreek or anise seeds.

3-3- Hormonal profile:

The findings showed that the higher T3 hormone concentration ($P \leq 0.05$) was recorded in V-line rabbits than in NZW weanling rabbits (Table 5). The level of T3 and T4 hormone concentrations for weanling rabbits in Gr3 significantly ($P \leq 0.05$) increased than those of the untreated rabbits in the control (Gr1). This could be attributed to the varied genetical makeup, which is a great important diagnostic significance through the protein's contribution and the involvement of the hormones and keeping the osmotic pressure balance, and maintaining the acid-base balance, in addition as a nutritional reserve source for the body's tissues and muscles. These results agree with the findings of Hanna et al., (2008), which revealed that the means of total protein, glucose, AST, total lipids, cholesterol and thyroxin hormone (T4) were significantly ($P \leq 0.01$ & 0.05) affected by the treatment with fennel and caraway seeds, whereas, the globulin and ALT values were not affected. In general, there were no significant interaction (B×T) effects on liver enzymes.

3-4- Thermoregulatory responses:

Data presented in Table 6 showed that the means of RT (ºC), RR (resp./min) and ET (ºC) for V-line rabbits significantly ($P \leq 0.05$) increased than those of the NZE rabbits. These differences could be explained in terms of cyclic variation occurring in rabbits, which causes increased metabolic rates and physiological activities in the female rabbits. Also, these increases in thermoregulatory responses could be reflecting the adverse effects of heat stress.

These results disagree with those of Kishk et al., (2009), who found insignificant differences between two breeds (NZW & Cal) in the rectal temperature and respiration rate.

Regarding the administration with herbal seeds (Herbana), the physiological responses (RT, RR, PR, ST, and ET) of weanling rabbits in Gr3, were significantly ($P \leq 0.05$) decreased than those of the control group (Gr1). This could be attributed to the decreased stressful effects of heat stress on the metabolic rate under high ambient temperature, which represents an important part of the total heat dissipation. These achieved results agree with those of Abd El-Hakeam et al. (1991) who recorded that exposing rabbits to high ambient temperature significantly increased both of rectal temperature and respiratory rate. No significant effects due to interaction (B×T) on thyroid hormone concentrations.

CONCLUSION

Generally, from these results could be concluded that the means of body weight and daily feed intake for weanling rabbits produced from the low-producer rabbit does administered with dried herbal seeds (Herbana) increased significantly than those of the untreated does. The means of T3 and T4 hormones for weanling rabbits produced from the low-producer and treated does (Gr3) were significantly ($P \leq 0.001$) increased by the Herbana administration, while the means of RT, RR, PR, ST and ET were significantly decreased than those of the control (Gr1).

Table (1): Environmental climatic conditions in the rabbit farm during the experimental period

Weeks	Ambient temperature (AT/°C)	Relative humidity (RH/%)	Temperature humidity index (THI/units)	Heat stress classification
1	25.86	50.57	24.07	Absence heat stress
2	28.86	49.14	26.52	
3	27.43	52.86	25.45	
4	31.14	52.29	28.63	Moderate heat stress
5	34.27	50.86	31.21	Very severe heat stress
6	33.14	50.86	30.21	
7	35.14	50.00	31.87	
8	34.27	52.43	31.28	
Overall means	31.26	51.09	28.70	Moderate heat stress

Table (2): Live body weight (BW) and daily weight gain (DWG) of weanling rabbits produced from does treated with Herbana under high ambient temperature.

Traits →		Body weight (BW/g)					Daily weight gain (BWG/g)			
Breed ↓ Treatment ↓		4 week	6 week	8 week	10 week	12 week	4-6 week	6-8 week	8-10 week	10-12 week
Effect of breed (B)										
NZW		487.9^{b}	800.0^{b}	1115.8^{b}	1455.2^{b}	1797.2^{b}	22.29^{a}	22.56^{a}	24.24^{a}	24.42^{a}
V-line		570.8^{a}	881.4^{a}	1205.6^{a}	1540.4^{a}	1888.3^{a}	22.18^{a}	23.15^{a}	23.91^{a}	24.85^{a}
SEM		8.66	9.71	14.42	15.04	17.14	0.44	0.79	0.99	0.93
Effect of herbal seeds treatment (T)										
Low (Gr1)		494.1^{b}	798.8^{c}	1115.9^{b}	1445.3^{b}	1785.5^{b}	21.76^{a}	22.65^{a}	23.53^{a}	24.30^{a}
Normal (Gr2)		520.9^{ab}	834.4^{b}	1150.0^{b}	1493.7^{b}	1833.4^{b}	22.38^{a}	22.54^{a}	24.55^{a}	24.26^{a}
Low+T (Gr3)		573.3^{a}	889.1^{a}	1216.2^{a}	1554.4^{a}	1909.4^{a}	22.57^{a}	23.37^{a}	24.15^{a}	24.26^{a}
SEM		10.61	11.89	17.66	18.42	20.99	0.54	0.97	1.21	1.14
Interaction (B×T)										
NZW	Low	440.0^{a}	753.7^{a}	1061.2^{a}	1390.0^{a}	1734.1^{a}	22.4^{a}	21.9^{a}	23.5^{a}	24.6^{a}
	Normal	478.1^{a}	778.1^{a}	1095.6^{a}	1448.1^{a}	1783.7^{a}	21.4^{a}	22.7^{a}	25.2^{a}	24.0^{a}
	L+T	545.6^{a}	868.1^{a}	1190.6^{a}	1527.5^{a}	1873.7^{a}	23.0^{a}	23.0^{a}	24.0^{a}	24.7^{a}
V-line	Low	548.1^{a}	843.7^{a}	1170.6^{a}	1500.6^{a}	1836.9^{a}	21.1^{a}	23.3^{a}	23.6^{a}	24.0^{a}
	Normal	563.7^{a}	890.6^{a}	1204.4^{a}	1539.4^{a}	1883.1^{a}	23.3^{a}	22.4^{a}	23.9^{a}	24.5^{a}
	L+T	600.6^{a}	910.0^{a}	1241.8^{a}	1581.2^{a}	1945.0^{a}	22.0^{a}	23.7^{a}	24.2^{a}	26.0^{a}
SEM		14.8	16.3	25.0	26.3	30.3	0.7	1.4	1.7	1.6

[A, b, c] Means with different superscripts in the same row are significantly different ($P \leq 0.05$).

Table (3): Daily feed intake and feed conversion ratio of weanling rabbits produced from does treated with Herbana under high ambient temperature

Traits → Breed ↓ Treatment ↓		Daily feed intake (DFI)				Feed conversion ratio (FCR)			
		4-6w	6-8w	8-10w	10-12w	4-6w	6-8w	8-10w	10-12w
Effect of breed (B)									
NZW		54.83^{b}	64.79^{a}	72.71^{b}	86.52^{a}	2.47^{b}	3.07^{a}	3.11^{a}	3.61^{a}
V-line		60.54^{a}	64.92^{a}	75.01^{a}	84.54^{a}	2.77^{a}	2.84^{a}	3.24^{a}	3.57^{a}
SEM		0.64	0.70	0.93	1.07	0.07	0.16	0.12	0.16
Effect of herbal seeds treatment (T)									
Low (Gr1)		55.00^{b}	65.18^{b}	71.43^{b}	85.56^{b}	2.59^{a}	3.07^{a}	3.21^{a}	3.64^{a}
Normal (Gr2)		57.25^{b}	61.18^{c}	74.37^{a}	82.25^{c}	2.57^{a}	2.72^{a}	3.07^{a}	3.50^{a}
Low+T (Gr3)		60.81^{a}	68.18^{a}	75.87^{a}	88.93^{a}	2.70^{a}	3.06^{a}	3.24^{a}	3.64^{a}
SEM		0.79	0.86	0.60	1.31	0.09	0.20	0.15	0.20
Interaction (B×T)									
NZW	Low	51.0^{a}	63.9^{b}	69.2^{a}	86.1^{ab}	2.29^{a}	3.19^{a}	3.04^{a}	3.62^{a}
	Normal	54.5^{a}	60.4^{c}	73.5^{a}	77.5^{b}	2.56^{a}	2.68^{a}	2.79^{a}	3.38^{a}
	L+T	59.0^{a}	70.1^{a}	75.4^{a}	90.0^{a}	2.56^{a}	3.32^{a}	3.31^{a}	3.85^{a}
V-line	Low	59.0^{a}	66.5^{a}	73.6^{a}	85.0^{b}	2.89^{a}	2.95^{a}	3.38^{a}	3.66^{a}
	Normal	60.0^{a}	62.0^{b}	75.2^{a}	87.0^{a}	2.56^{a}	2.77^{a}	3.17^{a}	3.62^{a}
	L+T	62.6^{a}	66.2^{a}	76.4^{a}	87.9^{a}	2.84^{a}	2.80^{a}	3.17^{a}	3.43
SEM		1.1	1.1	0.8	1.6	0.1	0.3	0.2	0.3

$^{A, b}$ Means with different superscripts in the same row are significantly different (P≤0.05).

Table (4): Blood metabolites of weanling rabbits produced from does treated with Herbana under high ambient temperature

Traits → Breed ↓ Treatment ↓		Blood proteins			Glucose (mg/dl)	Total Lipids (g/dl)	Triglycerides (g/dl)	Total cholesterol (g/dl)
		Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)				
Effect of breed (B)								
NZW		6.00^{b}	3.84^{b}	2.16^{a}	99.08^{a}	370.71^{a}	66.67^{a}	68.18 ^{a}
V-line		6.63^{a}	4.11^{a}	2.52^{a}	96.50^{a}	365.45^{a}	62.74^{b}	65.68^{a}
SEM		0.09	0.09	0.13	2.65	14.91	1.29	1.19
Effect of herbal seeds treatment (T)								
Low (Gr1)		5.97^{b}	3.74^{b}	2.22	105.11^{a}	388.82	80.26^{a}	82.87^{a}
Normal (Gr2)		6.60^{a}	4.15^{ab}	2.45	91.43^{ab}	348.40	52.08^{c}	53.82^{c}
Low+T (Gr3)		6.37^{a}	4.03^{a}	2.34	96.83^{b}	367.03	60.77^{b}	64.11^{b}
SEM		0.12	0.11	0.15	3.24	18.26	1.58	1.46
Interaction (B×T)								
NZW	Low	5.68^{a}	3.64^{a}	2.04^{a}	105.47^{a}	390.8^{a}	82.86^{a}	85.2^{a}
	Normal	6.27^{a}	4.00^{a}	2.27^{a}	94.61^{a}	352.8^{a}	56.42^{a}	55.1^{a}
	L+T	6.05^{a}	3.87^{a}	2.18^{a}	97.16^{a}	368.5^{a}	60.74^{a}	64.1^{a}
V-line	Low	6.26^{a}	3.84^{a}	2.42^{a}	104.7^{a}	386.9^{a}	77.66^{a}	80.5^{a}
	Normal	6.94^{a}	4.30^{a}	2.64^{a}	88.2^{a}	344.0^{a}	49.75^{a}	52.5^{a}
	L+T	6.68^{a}	4.18^{a}	2.50^{a}	96.5^{a}	365.5^{a}	60.80^{a}	64.0^{a}
SEM		0.17	0.16	0.22	4.7	26.4	2.22	2.0

$^{A, b}$ Means with different superscripts in the same row are significantly different (P≤0.05).

Table (5): Liver enzymes and thyroid hormones of weanling rabbits produced from does treated with Herbana under high ambient temperature

Traits → Breed ↓ Treatment ↓		Aspartate aminotransferase (AST;IU/L)	Alanine aminotransferase (ALT;IU/L)	Tri-iodotyronine (T3/ng/dl)	Thyroxin (T4 /ng/dl)
Effect of breed (B)					
NZW		27.93[a]	18.48[a]	1.22[b]	4.05[a]
V-line		26.64[a]	17.91[a]	1.32[a]	4.20[a]
SEM		0.74	0.61	0.03	0.11
Effect of herbal seeds treatment (T)					
Low (Gr1)		27.85[a]	18.64[a]	1.16[b]	3.64[b]
Normal (Gr2)		26.98[a]	17.72[a]	1.35[a]	4.55[a]
Low+T (Gr3)		27.13[a]	18.23[a]	1.30[a]	4.18[a]
SEM		0.91	0.74	0.04	0.13
Interaction (B×T)					
NZW	Low	27.25[a]	18.22[a]	1.09[a]	3.45[a]
	Normal	26.22[a]	17.59[a]	1.31[a]	4.54[a]
	L+T	26.45[a]	17.92[a]	1.27[a]	4.15[a]
V-line	Low	28.25[a]	19.06[a]	1.24[a]	3.82[a]
	Normal	27.75[a]	17.85[a]	1.40[a]	4.56[a]
	L+T	27.80[a]	18.53[a]	1.34[a]	4.21[a]
SEM		1.3	1.08	0.06	0.19

[A, b] Means with different superscripts in the same row are significantly different (P≤0.05).

Table (6): Thermoregulatory responses of weanling rabbits produced from does treated with Herbana under high ambient temperature

Traits → Breed ↓ Treatment ↓		Rectal temperature (°C)	Respiration rate (resp./min)	Skin temperature (°C)	Ear temperature (°C)
Effect of breed (B)					
NZW		39.20[b]	149.00[b]	38.59[a]	37.00[b]
V-line		39.46[a]	157.50[a]	38.70[a]	37.28[a]
SEM		0.04	0.74	0.04	0.04
Effect of herbal seeds treatment (T)					
Low (Gr1)		39.47[a]	156.80[a]	38.77[a]	37.26[a]
Normal (Gr2)		39.24[b]	152.87[b]	38.65[ab]	37.11[ab]
Low+T (Gr3)		39.28[b]	150.07[c]	38.52[b]	37.05[b]
SEM		0.05	0.91	0.05	0.05
Interaction (B×T)					
NZW	Low	39.35[a]	153.27[a]	38.71[a]	37.17[a]
	Normal	39.06[a]	146.45[b]	38.55[a]	36.91[a]
	L+T	39.18[a]	147.27[b]	38.51[a]	36.92[a]
V-line	Low	39.59[a]	160.32[a]	38.82[a]	37.36[a]
	Normal	39.42[a]	159.30[a]	38.74[a]	37.31[a]
	L+T	39.38[a]	152.87[b]	38.53[a]	37.18[a]
SEM		0.07	1.28	0.07	0.08

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الملخص العربى

الأداء الإنتاجي وبعض الإستجابات الفسيولوجية لصغار أرانب النيوزيلاندى والـ V-line حديثة الفطام الناتجة من أمهات الأرانب المنتجة لعدد قليل من الخلفة والمعاملة بالهيربانا تحت ظروف الإجهاد الحراري.

حاتم يوسف الحمادي[1]، أنس احمد العربي سالم[2] ، احمد عبدالكريم ابوغابة[3]

[1] قسم انتاج الدواجن- كلية الزراعة - جامعة أسيوط

[2] قسم الانتاج الحيواني- كلية الزراعة - جامعة أسيوط

[3] قسم انتاج الدواجن- كلية الزراعة - جامعة سوهاج

استهدفت هذه التجربة دراسة تأثير معاملة إناث الارانب منخفضة الإنتاج بالهيربانا خلال الإسبوعين الأخيرين من الحمل وإسبوعين بعد الولادة علي الاداء الإنتاجى وبعض الإستجابات الفسيولوجية في صغار الأرانب المفطومة.

استخدم فى هذه الدراسة عدد 48 انثى من صغار أرانب النيوزيلاندى والـ V-line، عمر 4 اسابيع والتي قسمت بالتساوي الى ثلاث مجموعات (16 خلفة: 8 نيوزيلاندى + 8 V-line). ولقد اشتملت المجموعة الاولي (الكنترول)، علي صغار الأرانب المفطومة الناتجة من أمهات ضعيفة الانتاج (2-3 خلفة/انثي/بطن) تحت الظروف البيئية بأسيوط، بينما اشتملت المجموعة الثانية علي صغار الارانب الناتجة من أمهات منتجة لعدد طبيعى من الخلفات (4-5 خلفة/ انثى/بطن). ولقد تضمنت المجموعة الثالثة علي صغار الأرانب المنتجة من أمهات ضعيفة الانتاج (2-3 خلفة/انثي/ بطن) بعد معاملتها ببذور النباتات الطبية المختبرة (الهيربانا) والمصنعة في صورة محببات بمعدل 1جم/ انثي يومياً.

ولقد أوضحت النتائج المتحصل عليها وجود فروق معنوية (عند مستوى معنوية 1%) بين نوعي الأرانب في وزن الجسم عند الأعمار المختلفة ، بالإضافة الي كمية الغذاء المستهلك خلال الفترة من 4-6 و 8-10 اسابيع من العمر. بينما وجدت هناك فروق معنوية بمعدل التحويل الغذائي خلال الفترة من 4-6 اسابيع من العمر.

أدي تعرض صغار أرانب النيوزيلاندى حديثة الفطام للعبء الحراري الي انخفاض معنوي (عند مستوى معنوية 5%) بمتوسطات البروتين الكلى، الألبيومين، الجلوبيولين، هرمون التراى ايودوثيرونين (T3)، بينما ازداد معنوياً تركيز الجليسريدات الثلاثية مقارنة بمثيلاتها فى أرانب الـ V-line. وبالمثل ازداد معنوياً (عند مستوى معنوية 1%) متوسط درجة حرارة المستقيم، معدل التنفس و درجة حرارة الأذن بصغار ارانب الـ V-line مقارنة بمثيلاتها فى أرانب النيوزيلاندى.

وبالإشارة الي المعاملة بالهيربانا ، فقلد إزداد معنوياً (عند مستوى معنوية 5%) متوسط وزن الجسم، معدل استهلاك الغذاء، البروتين الكلى، الألبيومين وتركيز هرمونى التراى ايودوثيرونين والثروكسين، بينما انخفض معنوياً مستوى الجلوكوز، الجليسريدات الثلاثية و الكوليستيرول الكلي بصغار أرانب مجموعة المعاملة مقارنة بصغار أرانب مجموعة المقارنة. وبالمثل فقلد إنخفضت معنوياً (عند مستوى معنوية 5%) درجة حرارة المستقيم، ومعدل التنفس، ورجتى حرارة الجلد والأذن بصغار الأرانب الناتجة من أمهات معاملة ببذور النباتات الطبية المجففة (الهيربانا) مقارنة بمثيلاتها بمجموعة المقارنة.

وبصفة عامة، يمكن أن نخلص إلي أن معاملة أمهات الأرانب منخفضة الإنتاج ببعض بذور النباتات الطبية المختبرة (الهيربانا) قد أدت إلي تحسن معنوي في وزن الجسم وكمية الغذاء المستهلك بالإضافة الي بعض المقاييس الفسيولوجية بصغار أرانب النيوزيلاندى والـ V-line تحت ظروف الإجهاد الحراري السائدة بصعيد مصر.

مفاتيح البحث: صغار الأرانب ، الهيربانا ، الأداء الإنتاجي، الدم، الإستجابات الفسيولوجية ، الاجهاد الحراري.