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Productive and reproductive performance of weaned V-line male rabbits orally administrated with mixture of some dried herbal seeds under Assiut climatic conditions

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Abstract

In recent years, medical and aromatic herbs have been used in rabbits' production to replace antibiotic and have increasingly important role. A total of 40 weaned V-line rabbit bucks were divided equally into four experimental groups. The bucks of the 1st group not treated and served as the control group, while those in the 2nd, 3rd and 4th groups were oral supplementation with mixture dried herbal seeds at level of 200 ,400 and 600mg /buck/day, respectively. The obtained results revealed significant (P≤0.05) increase in BW, BWG and FCR of the treated bucks than those of the control. However, results of total feed consumption showed insignificant differences. The averages of total protein, globulin, albumin and glucose (mg/dl) of treated groups increased significantly (P≤0.05) as compared with the control group. While the means of triglyceride and cholesterol decreased significantly (P≤0.05) in the treated bucks than those of the control group. The averages of live sperm, (%), Mass motility, (%), concentration (10^6/ml) and ejaculate volume (ml) of the treated bucks increased significantly (P≤0.05) than those of the control, while the reaction time (seconds) and abnormal sperm, (%) decreased significantly (P≤0.05) in the treated bucks than those of the control group. In conclusion, this study demonstrated that treating rabbit bucks raised under Assiut climatic conditions with a mixture of some dried herbal seeds at level of (200,400 and 600/buck/day) significantly improved growth performance, blood parameters and semen quality.

Keywords: herbal seeds, blood constituents, semen quality, V-line rabbit bucks.

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1. Introduction

Egypt is the fourth country in rabbit production, since it produces thousand tons of carcass and 7.6 million head of rabbits (Yearbook, 2013). About 83.4 % of rabbit production farms are centered in the strip of Lower Egypt (Yearbook, 2017). In contrast, the lowest strip in rabbit production is Upper Egypt strip by 2.9%. The efficiency of rabbit production (number of litters / numbers of does) was found to reach the highest percentage in Lower Egypt (57.1%) than those of the Middle Egypt which amounted 44.2% (Yearbook, 2017). It's known that the rabbit meat is the best for the human, due to its high nutrition and easy digestion. It's also recommended as a low sodium content and weight-reduction diets (El-Nagar *et al.*, 2010). Finzi and Amici (1991) reported that the rabbits are also characterized by rapid growth, good ability to utilize forages and fibrous plant materials as well as agricultural by-products. This means, that rabbits don't need a lot of concentrates in their rations. In addition, rabbits have more efficient feed conversion ratio and consequently low cost per breeding female with high profitability for small-scale system of production as well as in backyards. The use of antibiotics in animal and poultry production was banned by the European community since 2006 (Dias *et al.*, 2013). Several studies performed to increase the efficiency of feed utilization of rabbits, which consequently improve the growth rate and the immunity to achieve more efficient financial profitability (Perić and Lukić, 2009). Recently, Mossa *et al*. (2019) found that medicinal plants are widespread in rabbit feeds as antibiotics alternatives. (Ashour *et al.*, 2014), observed that many studies confirmed the beneficial nutrient retention, gut health, intestinal micro-flora, reduced susceptibility to diseases, enhanced immunity function and improved carcass yield and quality in poultry production. Therefore, the main objective of the present study is to investigate the effect of orally supplementing rabbit with mixture of some medical and aromatic plants such as Turmeric (*Curcuma longa*), ginger (*Zingiber officinale*), thyme (*Thymus vulgaris*) and garlic (*Allium sativum*) as natural growth promoters, on growth performance, some blood parameters and semen quality of V-line buck rabbits from 4 to 49 weeks of age.

2. Materials and methods

2.1 Site and the aims of the study

This experiment was carried out at a private rabbit farm (Al Frida Group farm), located in Abnuob city, Assiut government, Egypt, during the period from December 2020 to June 2021.

2.2 Animals, housing, ration, Experimental design and management

A total of 40 V- line weaned male rabbits were individually weighed and distributed into four comparable experimental groups (10 animals each). Animals of the first group did not treat and served as control, while animals of the other three groups (T1, T2 and T3)

were orally administrated with a mixture of dried herbal seeds at levels of 200, 400 and 600 mg/buck/day, respectively, during the experimental period (210 days). All rabbit were fed the same ration from 4 weeks (weaning) to 49 weeks of age. Ingredients and the proximate chemical composition determined according to (AOAC, 1990) as shown in Table (1). The feed was offered *ad libitum* and the fresh tap water was available for experimental all the time. All rabbits were individually housed in wire galvanized battery cages having the dimensions (50 L × 50 W × 40 H), raised under the same managerial conditions, and exposed daily to lighting hours (16 Light: 8 Dark).

Table (1): ingredients and chemical composition of the experimental ration.

Ingredients	%
Ground yellow corn	19.00
Wheat bran	11.00
Barley	17.20
Soybean meal (44%)	15.00
Berseem hay	33.00
Molasses	3.00
Di-calcium phosphate	1.00
Sodium chloride (salt)	0.30
Premix[1]	0.30
DL-methionine	0.10
L-lysine	0.10
Total	100.00
Chemical composition (% of DM basis)	
Dry matter	91.83
Crude protein	18.87
Ether extract	3.33
Crude fiber	13.57
Nitrogen free extract	54.89
Ash	9.34
Organic matter	90.66
DE, Kcal / Kg2	2502

Premix[1] contained the following vitamins and minerals mixture per kg (g/kg): Vit A., 2000.000 IU, Vit E, 10 mg, Vit B1, 400 mg, Vit B2, 1200 mg, Vit B6, 400 mg, Vit B12, 10 mg, Vit D3, 180000 IU, Colin chloride, 240 mg, Pantothenic acid, 400 mg, Niacin, 1000 mg, Folic acid, 1000 mg, Biotin, 40 mg, Manganese, 1700 mg, Zinc, 1400 mg, Iron, 15 mg, Copper, 600 mg, Selenium, 20 mg, Iodine, 40 mg and Magnesium, 8000 mg DE, Kg 2 digestible energy, = 4.36-0.0491 × NDF%, whereas NDF %: neutral detergent fiber, = 28.924 + 0.657 × CF%, whereas CF%: crude fiber.

2.3 Environmental conditions in the rabbit farm

The ambient temperature (ºC), relative humidity (%) and temperature humidity index (Units) were recorded inside the rabbitry all-over the day by using a thermo-hygrograph. The averages of ambient temperature, as well as the relative humidity and temperature humidity indexes percentages were determined as listed in Table (2). The ambient temperature was recorded at 10 AM and 6 PM. The temperature humidity index (THI) was calculated by using the equation of Marai *et al*. (2001) THI = db C- (0.31-0.31 × RH/100) × (db-C-14.4)). Where, db C = dry bulb temperature and

RH %= relative humidity. The THI values were classified as follow: absence heat stress (< 27.8), moderate heat stress (27.8-28.8), severe heat stress (28.9-29.9) and very severe heat stress (>30.0) as presented in Table (2).

Table (2). Average of ambient temperature, relative humidity and temperature humidity index during the experimental period.

Month	AT/ºC	RH/%	HI/units
December	22.1	51.4	20.8
January	18.9	48.2	19.6
February	20.6	58.6	22.1
March	23.2	60.1	24.6
April	30.68	68.75	29.10
May	33.15	63.55	31.03
June	35.8	60.18	33.16

AT/ºC =ambient temperature, RH/% =relative humidity and THI/units =temperature humidity index.

2.4 Growth performance

The initial and final body weights for each buck were recorded at 9.0 AM during the experimental period. The total BWG was calculated by subtracting the initial body weight from the final corresponding ones. The total feed consumption (g) was recorded during the same period. The feed conversion ratio (FCR) was calculated as g feed/g weight gain.

2.5 Blood parameters

The blood samples, 3ml blood were collected biweekly from the marginal ear vein at 10.0 AM in non-heparinized tubes to measure the biochemical analysis from 8 weeks of the treatment with herbal seeds to the end experiment. Blood serum was separated by centrifugation for 15 minutes at 3000 rpm and stored frozen (-20°C) in plastic vials until biochemical analysis. The total protein (TP) of serum was measured by using commercial kits according to the method of Armstrong and Corri (1960), while the serum albumin (Alb) was determined by using special kits according to Doumas *et al*. (1971). Globulin values were obtained by subtracting albumin concentrations from the corresponding values of the total protein. Triglyceride, glucose and cholesterol (mg/dl) levels in the serum were measured by using specialized commercial kits according to Doumas *et al*. (1971).

2.6 Semen samples

Semen samples were collected from each buck at 10 AM, by an artificial vagina with a teaser female rabbit. The reaction time (Sec) for each buck was determined by using a stopwatch as the time elapses up to the buck gives semen ejaculate. The semen volume, after removing gel excretion, was measured per ml by using a graduated collection tube to the nearest 0.1 ml and placed at 37ºC in a water bath according to Breederman *et al*. (1964).

The sperm concentration was microscopically examined and measured by using a hemocytometer slide, while the sperm live and abnormality percentages were assessed by the method described by Blom, (1983).

2.7 Statistical analysis

Collected data were subjected to on-way analysis of variance by using the general linear model produced (GLM) of the Statistical Analysis Systems (SAS, 2004). Differences among treatment means were detected by using Duncan's multiple ranges tests Duncan (1955). Data were analyzed according to the following model:

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

Where, Y_{ij}= the ij^{th} observation measured, μ= the overall mean, T_i= the effect of i^{th} treatment (i= T1 200 mg, T2 400 mg and T3 600 mg), e_{ij} = the error related to individual observation.

3. Results and discussion

3.1 Chemical analysis of the tested supplemented herbs

The chemical analysis of turmeric, ginger, thyme and garlic seeds are shown in Table (3). The obtained data showed that cured protein (CP) content was higher in Turmeric and Thyme than those in Ginger and Garlic (10.07 and 9.2% *vs.* 5.45 and 6.36 %), while cured fiber (CF) and ash content were statistically higher in ginger compared with other herbs (10.36 and 6.57%).

Table (3): Chemical analysis of the tested supplemented herbal additives.

Chemical analysis	Turmeric (*Curcuma longa*)	Ginger (*Zingiber officinale*)	Thyme (*Thymus vulgaris*)	Garlic (*Allium sativum*)
Total feed additives (%)				
Protein	10.07	5.45	9.2	6.36
Fat	0.27	0.32	0.28	0.50
Crude fiber	4.87	10.36	2.33	2.10
Ash	2.76	6.570	1.17	3.22
Mineral (ppm)				
Calcium	1.67	3.45	2.64	1.81
Magnesium	0.92	0.86	0.88	0.41
Potassium	1.29	2.70	1.70	2.50
Phosphorus	1.07	1.59	2.06	1.53
Iron	0.06	0.08	0.16	0.11
Selenium	0.06	0.07	0.09	0.04

On the other hand, the chemical also revealed that Garlic had a higher content of fat (0.5%) and a lower content of CF (2.10%) than those in turmeric, ginger and thyme. Generally, the chemical composition of our feed additives was somewhat comparable to those reported by Imoru *et al*. (2018) and Ogbuewu *et al*. (2014).

3.2 Growth performance

Data presented in Table (4) showed that the averages of the final body weight (FBW), total weight gain (TWG**)** and

feed conversion ratio (FCR) of the treated rabbit bucks were significantly higher (P≤0.05) than the control. There were no significant differences in feed consumption (FC) among rabbits' bucks. This improvement in FBW**,** TWG and FCR due to the supplementation of a mixture dried herbal seeds could be attributed to the improved digestibility of crude protein, which in turn increased the intestinal absorption capacity and the utilization of protein and the other nutrients. These results agree with those of Ahmed *et al*., (2020), who found that the averages of BW, BWG and FCR OF NZW rabbit bucks treated with thyme at level 4, 8, 12 and 16 g/kg diet increased significantly (P≤0.05) than those of the control group. Similar results were obtained by Desouky *et al*. (2019) who reported that the supplementation of ginger at 5 mg/kg diet and thyme at 5 mg/kg diet increased significantly (P≤0.05) the final body weight and body weight gain of NZW rabbit bucks as compared with the control group.

Table (4): Impact of oral supplementation of some dried herbal seeds on the productive traits.

Items	Treatments				Significance
	Control	T1	T2	T3	
Initial BW (g)	620±20.59	702±10.91	715±20.34	693±5.82	Ns
Final BW (g)	4878^{c}±34.66	5355^{b}±43.55	5574^{b}±162.20	6400^{a}±128.2	*
Total BWG (g)	304.14^{c}±42.47	332.3^{b}±41.09	347.0^{b}±32.74	407.6^{a}±48.37	*
Total FC (g)	27063±128.23	33072±170.7	35720±89.33	42374±216.8	NS
FCR (g feed/ g gain)	2.36^{c}±0.01	2.11^{b}±0.011	2.04^{b}±0.04	2.02^{a}±0.10	*

$^{a, b, c}$ Means with different superscripts in the same column for every factor are significantly different (P≤0.05) NS= Not significance and * = significance (P≤0.05), T1= rabbits supplemented with 200 mg mixture of dried herbal seeds. T2= rabbits supplemented with 400 mg mixture of dried herbal seeds. T3= rabbits supplemented with 600 mg mixture of dried herbal seeds.

3.3 Blood parameters

Regarding to the effect of mixture dried herbal seed, data presented in Table (5) showed that the means of total protein concentration, albumin, globulin and glucose in rabbit bucks treated with mixture herbal seeds increased significantly (P≤0.05) than the rabbit bucks in the control group. While the concentration of triglyceride and cholesterol decreased significantly (P≤0.05) in the treated rabbit bucks than the untreated rabbit bucks. This increase could be attributed to the improved digestibility of crude protein, which consequently saved and increased the available amino acids for the treated rabbits. These findings agree with those of Alagawany *et al*. (2016) who reported that the serum total protein, albumin, globulin and glucose in growing rabbits, which were oral supplemented with turmeric and garlic at level of 2, 4 and 8 mg/kg/BW increased significantly than the control group. Similarly, the findings of Attia *et al*. (2014) indicated that the albumin and globulin concentrations were insignificantly influenced (P≤0.05) by orally supplementation with Garlic at level of 100, 200 and 300 mg/kg/BW of rabbit bucks. The increased level of the

serum glucose in the treated rabbits bucks may be attributed to the high level of carbohydrates present in dried herbal seeds, which consequently supported and increased the glucose level in the blood, needed to cover the physiological requirements of the body. The lower cholesterol and triglyceride concentration in the treated rabbit bucks may be attributed to the role of herbal seeds in lipid metabolism, which prevents the accumulation of lipid peroxidation products. These findings agree with those of Gálik *et al*. (2016) who found that the lower cholesterol and triglyceride concentrations decreased significantly (P≤0.05) in treated rabbit bucks with turmeric 250 and 300 mg/kg/LBW as compared with those of the control group.

Table (5): Impact of oral supplementation with some dried herbal seeds on the biochemical parameters of rabbits bucks.

Parameters	Treatments				Significance
	Control	T1	T2	T3	
Total protein (g/dl)	5.46^{d}±0.20	6.76^{c}±0.17	6.80^{b}±0.12	7.76^{a}±0.13	*
Albumin (g/dl)	$3.80^{c\pm}$0.17	4.33^{b}±0.15	4.36^{b}±0.13	5.03^{a}±0.18	*
Globulin (g/dl)	2.13^{c}±0.13	2.96^{b}±0.17	2.96^{b}±0.19	3.70^{a}±0.23	*
Glucose (g/dl)	86.76^{d}±0.01	93.43^{c}±0.96	101.5^{b}±1.64	117.8^{a}±2.0	*
Cholesterol (mg/dl)	80.60^{a}±1.9	77.6^{b}±2.0	69.7^{c}±2.1	56.9^{d}±1.5	*
Triglyceride (mg/dl)	102.2^{a}±1.87	85.43^{b}±3.01	75.5^{c}±1.03	70.33^{d}±1.51	*

a, b, c and d Means with different superscripts in the same column for every factor are significantly different. * = significance (P≤0.05), T1= rabbits supplemented with 200 mg mixture of dried herbal seeds. T2= rabbits supplemented with 400 mg mixture of dried herbal seeds. T3= rabbits supplemented with 600 mg mixture of dried herbal seeds.

Similarly, the findings of Jubril (2019) who found a significant decrease (P≤0.05) in the cholesterol and triglyceride concentration of rabbits fed a commercial ration supplemented with 0.25, 0.50 and 0.75 g/Kg diet ginger as compared with the control group.

3.4 Semen characteristics

In Table (6) the obtained results showed that the reaction time (seconds) of bucks in orally treated groups increased significantly (P≤0.05) than those of the control group. The decrease of the reaction time in treated groups could be considered as good indication for the higher sexual activity and the more secretion of testosterone hormone. The achieved findings agree with those of El-Rawi et *al*. (2020) which revealed that the sexual libido decreased significantly in V-line rabbit bucks, receiving turmeric at 4 and 8 g/kg diet than those of the control group. Similarly, the findings of Abd El-hameed Noura and Heshmat (2019) showed that the semen characteristics of rabbit bucks administrated with ginger 200 and 250 mg/kg/BW increased significantly than those of the control group. The means of ejaculate volume, live sperms (%) and mass motility (%) as well as sperm concentration/ml for rabbit bucks supplemented with the mixture of herbal seeds increased significantly (P≤0.05) than those of rabbit bucks in the

control. The significant improvement in the semen characteristic in the treated groups may be attributed increased in LH hormone concentration, which plays an important role in promoting the secretion of testosterone hormone from leydig cells, which stimulate the germinal cells to produce more sperms. These results agree with those of Zeweil *et al*. (2016) who stated that the lower abnormal sperm percentages were obtained in male mice treated with turmeric 1 and 2 g/kg/diet while a higher percentage was recorded in the control group. Similarly, the results of Kauser *et al*. (2020) showed that the abnormal sperm was decreased significantly (P≤0.05) in NZW rabbit bucks supplemented with garlic at 500 and 1000 mg/kg/BW than those of the control group.

Table (6): Impact of oral supplementation with some dried herbal seeds on semen physical characteristics.

Items	Treatments				Significance
	Control	T1	T2	T3	
Reaction time (seconds)	17.0^{a} ±0.91	14.0^{b} ±0.91	13.0^{b} ±0.91	10.0^{c} ±0.91	*
Ejaculate Volume (ml)	0.68^{c} ±0.05	0.81^{b} ±0.05	0.85^{b} ±0.05	1.02^{a} ±0.05	*
Live sperms (%)	54.0^{d} ±1.91	69.6^{c} ±1.91	81.6^{b} ±1.91	93.1^{a} ±1.91	*
Mass motility (%)	52.3^{d} ± 0.18	75.6^{c} ±0.01	84.0^{b} ±0.08	94.0^{a} ±0.01	*
Concentrate/ml (10^{6})	103.3^{d} ±7.90	171.6^{c} ±7.90	236.6^{b} ±7.90	310.0^{a} ±7.90	*
Sperm abnormalities (%)	25.0^{a} ±0.03	20.0^{b} ±0.03	16.0^{c} ±0.03	10.0^{d} ±0.03	*

$^{a, b, c \text{ and } d}$ Means with different superscripts in the same column for every factor are significantly number of semen samples = 300, NS= Not significance, * = P≤0.05. T1= rabbits supplemented with 200 mg mixture of dried herbal seeds. T2= rabbits supplemented with 400 mg mixture of dried herbal seeds. T3= rabbits supplemented with 600 mg mixture of dried herbal seeds

5. Conclusion

Administrating rabbit bucks daily with a mixture of some dried herbal seeds (200, 400 and 600/buck/day) significantly improved growth performance (BW, BWG, and FCR). The semen quality values in oral treated rabbit bucks enhanced significantly compared with the control group without any negative effects on blood biochemical. Therefore, from above results, it may be considering a mixture of dried herbal seeds as potential feed additive for rabbit bucks under Assiut climatic conditions.

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