USING ANISE LEAVES (*PIMPINELLA ANISUM L.*) FOR IMPROVING OF PERFORMANCE NEW ZEALAND RABBITS.

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SUMMARY

Thirty-six of unsexed New Zealand rabbits (5-6 weeks old and average weight 654.64± 2.75 g were randomly distributed into 4 groups (9 each, in 3 replicates. Experimental rabbits were fed on a basal diet containing anise leaves (*Pimpinella anisum L.*) by levels 0, 2, 4 and 6% to the experimental animal groups. All the experimental diets were formulated to meet the nutrient requirements of rabbits according to NRC (1977). The feeding trail extending to 56 days. The diets containing different levels of anise leaves (D2, D3 and D4%) were the highest (P<0.05) significantly of DM, OM and CP% digestibility, the highest values digestibility was recorded with diet (D4) by 19.29, 25.42 and 19.81%, followed by diet (D3) by11.50, 7.79 and14.07 %, finally diet (D2) by 10.35, 4.11 and 15.16% compared with control diet (D1) which values 64.90, 64.74 and 67.14%, respectively. Whereas, EE did not differ significantly among the experimental diets. Otherwise, anise leave 2% in diet D2 decreased (P<0.05) CF digestibility by 6.51%, but the diet (D3) was significant increased by 82.70%, the highest values were recorded with D4 by 214.32%. Digestibility of NDF, ADF, hemicellulose, cellulose and NDF-cell soluble% tend to be higher in diet D4, followed by D3 compared to the control. Nutritive values TDN, DCP and DE were significant increased with diet D4 by 16.42%, 25.88% and 21.64(kcal/ kg DM), followed by D2 by14.04%, 15.35% and 10.62(kcal/ kg DM), while the lowest nutritive values recorded with diet D3 by 20.19% ,16.42% and 13.21(kcal/ kg DM), respectively. Blood plasma constituents of the dietary rations as not significantly affected by anise leaves. Plasma total protein, albumin, globulin, lipids (total cholesterol, LDL-Cholesterol, HDL-Cholesterol, Triglycerides), kidney function (urea, creatinine) and liver function alkaline phosphatase, AST and ALT).The inclusion of anise leaves in rabbits' diets significantly (P<0.05) enhanced the body weight and the body weight gain as compared to the control diet. Rabbits fed diet containing (6%) D4 anise leaves showed significantly (P<0.05) enhancing in the final body weight, average daily gain and total feed intake and the best decrease of FCR and economic efficiency compared to control D1. No significant differences were observed in total giblet, lung and kidney among the experimental groups. The testes percent showed significant increase due to feeding diet containing anise leaves which may be due to anise phytoestrogens effect. Costing of one kg feed, (LE) was decreased by inclusion anise leaves in test diet compared to control diet. Conclusion: In conclusion, it can used anise leaves (Pimpinella anisum L.) in rabbit diets up to 6% to improve nutritive and feeding values, growth parameters as well as realized the highest value of feed efficiency and relative economic efficiency.

Keywords: *Anise leaves, nutritive values, growth parameters, caraccas weight, blood plasma, nitrogen balance, parameter caecum and economic efficiency*

INTRODUCTION

Anise (*Pimpinella anisum* L.) is an annual aromatic plant belonging to the *Apiaceae family*. It is cultivated mainly in Southern Europe and Southeast Asia. Anise fruits or the so-called seeds are the used parts of the plant (Al-Beitawi *et al.*, 2009). According to Franz *et al.* (2005) they contain 2-6% essential oils, phenolic acids, eugenol, estragole and trans-anethole – a powerful phytoestrogen which is the main component of the oil (80-95%). Anise is a natural herbal plant that grows widely in Egypt and many Arab countries. Anise is commonly used in human nutrition to regulate the balance of somatic and sexual hormones. It contains essential and fatty acids, the main component of the essential oils is anethol and the biological properties are inhibiting bacterial (Sagdic and Ozcan, 2003) and fungal (Soliman and Badea, 2002) stimulating secretion of digestive enzyme and appetizing (Seleem, 2008). The Romans discovered that anise seeds and others aromatic spices helped digestion. Feed additives have been widely used to

increase the performance of animals, and used in poultry feeding practices extensively Khan *et al*., (2007) not only to stimulate the growth and feed efficiency but also, to improve the health and performance of birds (Fadlalla *et al.*, 2010; Abouelfetouh *et al*., 2012). In past, several antibiotic growth promoters had been used in poultry feed aiming to prevent disease, to improve growth performance, and to increase some useful microorganism in intestinal microflora.

Anise has been examined for its antiparasitic and digestion stimulating properties (Cabuk *et al.*, 2003), antibacterial (Tabanca *et al.*, 2003) and antifungal (Soliman and Badea, 2002) , antipyretic (Afifi *et al.*, 1994), antioxidant (Gulcin *et al.*, 2003), antimicrobial (Al-Kassie, 2008), anthelmintic (Bhatti *et al.*, 1996) and hypocholesterolemic (Craig, 1999) activities. Additionally, anise is reported to possess anticonvulsant (Pourgholam *et al.*, 1999), antiepileptic (Janahmadi *et al.*, 2008) and muscle relaxant (Albuquerque *et al.*, 1995) properties. Some studies have been conducted to evaluate the use of anise seed or oil in poultry nutrition, especially to replace antibiotics as growth promoters (Ciftci *et al.*, 2005; Soltan *et al.*, 2008; Al-Beitawi *et al.*, 2009). The varied effects of extracts from different parts of anise could be attributed to the differences in their phytochemical constituents. Different parts contain different bioactive compounds at different levels. This result is in consistent with that of Embong *et al.* 1997) and his colleagues, who investigated the components of the whole plants and the seeds of *Pimpinella anisum* and reported that the major oil constituent (the flavonidetrans-anethole)−which is widely known to have strong biological activities −was 57.4% of whole plant and 75.2% of seed oil. A similar trend was observed also in other medicinal plants such as chicory (Embong *et al.* 1997). Jurgoński *et al.* (2011) investigated the chemical composition of the seed, peel, leaf, and root extracts and found that the seed extract was the richest source of minerals, fat, protein, and most importantly, phenolic compounds

The objective of this study was to evaluate the effect of using anise leaves on digestibility, Nitrogen balance, blood parameters, caecum activity, phytochemical evaluation and growth performance of rabbits

MATERIAL AND METHODS

Thirty-six of unsexed New Zealand rabbits (5-6 weeks old and average weight range from 654.67±2.75g) were randomly distributed into 4 groups (9 each, in 3 replicates. Experimental rabbits were fed on a basal diet containing anise leaves (*Pimpinella anisum L.*). Anise leaves were purchased from local market. Anise leaves were dried, milled and incorporated into the experimental diet. Anise leaves containing in feed rabbits by levels 0, 2, 4 and 6% to fed animals of group D1, D2, D3 and D4, respectively. Animals of group D1, were serving as control group. All the experimental diets were formulated to meet the nutrient requirements of rabbits according to NRC (1977). The experimental period was in the summer season of 2018.

The experimental diets and chemical analysis of the experimental diets are shown in Tables (1 and 2). The feeding trail extending for 8 weeks. Chemical analysis of the experimental diets, feces and urine were determined according to method of AOAC (2005), while determined by calculated of (Gross energy (Kcal/kg DM) =Each g CP= 5.65 Kcal, g EE= 9.40 Kcal and g (CF & NFE) = 4.15 Kcal. was calculated according to Blaxter (1968), Digestible energy (Kcal/kg DM) = 4253 – 32.6 (CF %) – 144.4 (total ash). was calculated according to Fekete and Gippert (1986) and Non fibrous carbohydrates (NFC) = 100 – {CP + EE + Ash + NDF} were calculated according to (Calsamiglia *et al.* 1995). The performance of the experimental rabbits in term of feed intake, live weight gain and feed conversion ratio were recorded weekly. Health of the experimental diets and mortality rate were closely observed and recorded daily.

Data collection and analysis:

Data were recorded for weekly body weight gain and feed intakes. At the end of the experimental period, all rabbits were used in digestibility trials over period of 7 days to determine the nutrient digestibilies coefficient, nutritive value, feeding values, nitrogen balance and caecum activity of the tested diets. Cell wall constituents includes neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were evaluated according to Goering and Van Soest (1970) and Van Soest *et al.*, (1991). Blood samples were collected during the slaughter process to determine, Plasma total cholesterol concentration according to Roeschlau et al. (1974) method. Plasma triglycerides was measured according to Fossati and Prencipe (1982) method. Plasma total protein was determined according to Armstrong and Carr (1964); albumin according to Doumas *et al.* (1971). Globulin was

calculated by subtracting the albumin value from total protein value. Liver function enzymes Plasma aspartic aminotransferase (AST) and Alanine aminotransferase (ALT) activities were measured by using the commercial kits from sentinel CH according to the method that described by Reitman and Frankel (1957).

Table (1): Chemical analysis and cell wall constituents of Anise leaves and Berseem hay (on matter basis)

Item	Anise leaves	Berseem hay
Dry matter (DM)	89.6	94.44
Organic matter (OM)	85.00	85.50
Crude protein (CP)	11.38	14.34
Crude fiber (CF)	14.4	25.24
Ether extract (EE)	7.7	2.45
Ash	14.17	14.50
Nitrogen free extract (NFE)	52.35	43.47
Fiber constituent:		
Neutral detergent fiber (NDF)	36.52	53.69
Acid detergent fiber (ADF)	33.73	36.36
Acid detergent lignin (ADL)	20.19	10.6
Hemicellulose	2.78	17.06
Cellulose	13.54	26.03
NDF-cell soluble	63.48	46.31
NFC	30.23	15.02
CHO	88.87	97.16

Non fibrous carbohydrates (NFC) were calculated according to (Calsamiglia et al.1995) using the following equation: NFC = 100 – {CP + EE + Ash + NDF}, CHO = NDF+NFC

Table (2): The composition of the dietary diets

Item	Experimental diets			
	D_1	D_2	D_3	D_4
Yellow Corn	33.00	33.00	33.00	33.00
Soybean seeds, meal	26.00	26.00	26.00	26.00
berseem hay	29.77	27.77	25.77	23.77
Sunflower oil, refined	2.05	2.05	2.05	2.05
Corn Gluten Meal	1.00	1.00	1.00	1.00
Anise leaves	0.00	2.00	4.00	6.00
Calcium phosphate, dibasic	1.50	1.50	1.50	1.50
Sugar Cane Molasses	3.00	3.00	3.00	3.00
Coarse Wheat bran	1.40	1.40	1.40	1.4
Salt	0.35	0.35	0.35	0.35
Limestone	1.15	1.15	1.15	1.15
Methionine	0.33	0.33	0.33	0.33
L-Lysine HCL 98%	0.15	0.15	0.15	0.15
Premix	0.30	0.30	0.30	0.30
Total	100	100	100	100
Price	5500	5490	5480	5497

*D1: Control diet. D2: Control diet contained 2% anise leaves. D3: Control diet contained 4% anise leaves. D4: Control diet contained 6% anise leaves. * Premix: Each kilogram of premix contains: 2000.000 IU Vit. A, 150.000 IU Vita. D, 8.33 g Vit. E, 0.33 g Vit. K, 0.33 g Vit. B1, 1.0 g Vit. B2, 0.33g Vit. B6, 8.33 g Vit.B5, 1.7 mg Vit. B12, 3.33 g Pantothenic acid, 33 mg Biotin, 0.83g Folic acid, 200 g Choline chloride, 11.7 g Zn, 12.5 g Fe, 16.6 mg Se, 16.6 mg Co, 66.7 g Mg and 5 g Mn.*

Alkaline phosphatase colorimetric method measured according to Belfield and Goldberg (1971), urea according to Patton and Crouch, (1977). Creatinine level was determined spectrophotometriccally using

special kits according to the method described by Bartles(1972). Caecum was taken for all slaughtered rabbits and determination of P^H, ammonia nitrogen (NH3-N) and total volatile fatty acids (VFA's) of caecum content according to Conway (1958) and Eadie (1967) methods.

The data was statistically analyzed with the standard procedures of analysis of variance (ANOVA), using the general liner model procedure Proc GLM; SAS Institute, (2002). Differences among means were determined using Duncan's test Duncan, (1955).

RESULT AND DISCUSSION

The chemical composition:

There were significant ($P<0.05$) different in the chemical composition and fiber fraction of different forages anise leaves and berseem hay are shown in (Table 1). The DM, CP and CF% of anise leaves was the lowest values compared with berseem hay by 5.12, 20.64 and 42.95%, respectively. while the highest values are 7.7, 52.53% and 97.16 % as dry matter basis compared with berseem 2.45, 43.47% and 88.87% of EE, NFE and CHO. The fiber constituent values of anise leaves were decreased of NDF, ADF,

Table (3): Chemical analysis and cell wall constituents of the dietary rations.

Item %	Experimental diets			
	$D_{1\ (control)}$	D_2	D_3	D_4
Dry matter (DM)	93.38	93.47	92.29	91.8
Chemical analysis on DM basis				
Organic matter (OM)	88.6	89.45	89.67	89.74
Crude protein (CP)	20.35	20.44	20.8	20.81
Crude fiber (CF)	10.42	8.75	8.67	9.16
Ether extract (EE)	4.71	5.35	5.91	6.09
Nitrogen-free extract (NFE)	53.12	54.92	54.29	53.69
Ash	11.40	10.55	10.33	10.26
Gross energy (Kcal/kg DM)[1]	4225.28	4300.07	4343.58	4356.50
Digestible energy (Kcal/kg DM)[2]	2267.15	2444.33	2478.71	2472.84
Non fibrous carbohydrates (NFC)[3]	46.12	49.81	49.05	49.11
Cell wall constituents (%)				
Neutral detergent fiber (NDF)	18.65	16.82	15.07	14.96
Acid detergent fiber (ADF)	13.44	13.13	12.06	11.15
Acid detergent lignin (ADL)	3.68	3.61	3.13	2.93
Acid insoluble ash	1.90	2.04	1.65	1.63
Hemicellulose	5.22	3.69	3.01	3.80
Cellulose	9.76	9.52	8.93	8.22
lignin	1.79	1.56	1.49	1.30
NDF-cell soluble	81.35	83.18	84.93	85.04

D1: Control diet. D2: Control diet contained 2% anise leaves. D3: Control diet contained 4% anise leaves. D4: Control diet contained 6% anise leaves

1: Gross energy (Kcal/kg DM) was calculated according to Blaxter (1968), where, each g of crude protein (CP) =5.65 kcal , each g of ether extract (EE) = 9.40 kcal, and each g crude fiber (CF) and nitrogen-free extract (NFE) = 4.15Kcal. 2: Digestible energy (Kcal/kg DM) was calculated according to Fekete and Gippert (1986) using the following equation: DE (kcal/ kg DM) = 4253 – 32.6 (CF %) – 144.4 (total ash). 3: Non fibrous carbohydrates (NFC) were calculated according to (Calsamiglia et al. 1995) using the following equation: NFC = 100 – {CP + EE + Ash + NDF}. Hemicellulose = NDF – ADF. Cellulose = ADF – ADL.

hemicellulos and cellulose by 31.98, 7.23, 83.70 and 47.98, respectively, but NDF-cell soluble were increased by 37.07% compared with berseem hay. Christaki *et al.,* (2011) Showed that the Chemical analysis of anise leaves are 93.5% DM, 12.9% CP,13.8% EE, 20.2%CF and 8.2% ash. On the other hand,

the data of the formula of experimental diets Similar trend was found with their CF and cell- wall constituents were decreased of diets containing anise leaves. The EE and NDF-cell soluble were increased with increased levels anise leaves in diets.

Digestibility coefficient:

Data of digestibility coefficient are shown in Table (4). The diet containing different levels anise leaves (D2, D3 and D4) was the highest (P<0.05) significantly of DM, OM and CP % digestibility. The highest values digestibility was recorded with diet (D4) by 19.29, 25.42 and 19.81%, followed by diet (D3) by11.50, 7.79 and14.07 %, finally diet (D2) by 10.35, 4.11 and 15.16% compared with diet (D1) which values 64.9, 64.74 and 67.14%, respectively. Whereas, EE did not differ significantly among all diets. Otherwise, anise leave 2% in diet (D2) decreased (P<0.05) of the CF digestibility by 6.51%, but the diet (D3) was significant increased by 82.70%, the highest values were recorded with 214.32% recorded with (D4). Digestibility of NDF, ADF, ADL hemicellulose, cellulose and NDF-cell soluble% tend to be higher in diet (D4), followed by (D3) compared to the control. Finally, the highly best result was recorded with dietary ration (D4) which content 6% anise leaves. Nutritive values (TDN, DCP and DE) were significant increased with diet (D4) by 16.42%, 25.88% and 21.64(kcal/ kg DM), respectively, followed diet (D2) by14.04%, 15.35% and 10.62(kcal/ kg DM). While the lowest nutritive values recorded with diet (D3) by 20.19% ,16.42% and 13.21(kcal/ kg DM), respectively. The response may be due to the essential oil of anise that may increase digestion of protein, cellulose and fat% Jamroz and Kamel, (2002).

Table (4): Digestibility coefficients and nutritive values (%) of the diets.

Item	Experimental diet				± Std.E
	D_1	D_2	D_3	D_4	
Digestibility %					
Dry matter (DM)	64.9^{c} ± 0.1	71.62^{b} ±0.6	72.36^{b} ± 1.6	77.42^{a} ± 0.5	±0.892
Organic matter (OM)	64.74^{c}± 1.6	67.40^{bc}± 1.7	69.78ab± 1.1	73.57^{a}± 0.3	±1.28
Crude protein (CP)	67.14^{b} ± 1.4	77.32^{a} ± 2.0	76.59^{a} ± 3.2	80.02^{a} ± 1.3	±2.12
Crude fiber (CF)	14.45^{cb} ± 2.7	13.51^{c} ±1.8	26.40^{b} ± 6.5	45.42^{a} ± 2.0	±3.76
Ether extract (EE)	90.5 ± 2.6	96.063 ± 2.4	90.78 ± 1.7	93.463 ± 0.4	±1.98
Nitrogen-free extract (NFE)	97.74 ± 2.2	80.17± 2.3	82.47 ± 1.5	85.17 ± 0.6	±1.78
cell-wall constituent digestibility%:					
Neutral detergent fiber	14.58^{b} ± 5.1	24.79^{b} ±4.3	24.26^{b} ± 4.0	40.52^{a} ± 1.5	±4.32
Acid detergent fiber	12.66^{c} ± 0.5	19.67^{b} ±2.0	17.87^{b} ± 4.0	30.97^{a} ± 2.7	±2.63
Hemicellulose	43.2 ±21.1	35.82 ± 20.6	49.92 ± 6.0	68.59 ±2.3	±15.12
Cellulose	22.71^{c} ±0.8	40.01^{ab} ± 2.5	36.04^{b} ± 2.8	43.82^{a} ± 1.2	±2.01
NDF-cell soluble	74.44^{c} ±0.7	80.11^{b} ± 0.9	81.36^{ab} ± 1.3	83.96^{a} ± 0.5	±0.9
Nutritive values					
Total digestible nutrient (TDN%)	67.36^{b} ± 1.5	76.82^{a} ±0.2	68.72^{b} ±1.4	78.42^{a} ± 0.6	±0.52
Digestible crude protein (DCP%)	13.68^{b} ±0.3	15.78^{a} ± 0.5	15.93^{a} ±0.7	17.22^{a} ± 0.6	±1.07
Digestible energy(kcal/kg)	2901.73^{c} ±15.5	3209.88^{b} ±9.8	3284.98^{b}±55.3	3529.87^{a}±59.1	±41.47

D1: Control diet. D2: Control diet containing 2% anise leaves. D3: Control diet containing 4% anise leaves. D4: Control diet containing 6% anise leaves.

a, b and c: Means in the same row having different superscripts differ significantly (P<0.05). SEM, standard error of the mean.

DE (kcal/kg) = 5.28(DCP g/kg) +9.51 (DEE g/kg) + 4.20 (DCF g/kg) + 4.20 (DNFE g/kg). Schiemann et al., (1972).

Blood plasma constituents:

Data in Table (5) presents that, there were no significant differences between experimental treatments for rabbits that were fed on diets containing anise leaves in blood plasma constituents compared to the control group (Plasma total protein, albumin, globulin, lipids (total cholesterol, LDL-Cholesterol, HDL-Cholesterol, Triglycerides), kidney function (urea, creatinine) and liver function alkaline phosphatase, AST and ALT) except triglycerides was significant decreased and the highest decreased recorded with

D4. These results correspond to what he found by Soltan *et al.* (2008) revealed that anise supplementation non-significantly decreased cholesterol concentration, while HDL-cholesterol increased with anise supplementation at 1.0, and 1.25 g/ kg while, these results agreement with that the decrease in serum ALP may provide evidence for the occurrence of hepatoprotective effect of or anise and its essential oils (Langhout, 2000; Williams and Losa, 2001 and Hernandez *et al.*, 2004). On the contrary, these results disagreement with Tagwa (2010) and Mukhtar *et al.* (2013). who results illustrated that the serum total protein, albumin and globulin were significantly (P<0.01) increased due to different supplementations as compared with the diet (control).

Table (5): Blood plasma constituents of the dietary rations

Item	Experimental diet				± Std.E
	D_1	D_2	D_3	D_4	
Total protein (g/dl)	7.19±0.9	6.51±0.9	6±0.2	5.53±0.1	±0.53
Albumin (g/dl)	3.88±0.0	3.97±0.5	3.74±0.1	3.83±0.1	±0.15
Globulin (g/dl)	3.32±0.9	2.55±0.5	2.26±0.2	1.7±0.2	±0.49
Albumin: Globulin ratio	1.86±0.2	1.64±0.0	1.60±0.1	1.45±0.1	±0.13
Lipids					
Triglycerides (mg/ dl)	86.00^{a}±9.5	83.00^{ab} ±30.3	78.00 ^{ab}±4.4	66.00^{b}±7.0	±10.05
Total cholesterol (mg/ dl)	90.32±25.2	76.95±58.9	68.72±6.1	59.65± 20.3	±21.34
LDL-Cholesterol (mg/ dl)	45.00±23.3	42.60±45.5	11.13±3.2	34.20±17.1	±17.13
HDL-Cholesterol (mg/ dl)	30.02±2.3	50.35±26.9	27.55±1.9	38.73±3.3	±8.01
Kidney function					
Urea	60.78±1.0	78.59±13.7	57.52±2.8	61.11±2.6	±4.40
Creatinine (mg/dL)	1.73±0.1	1.75±0.1	2.17±0.2	1.73±0.1	±0.13
Liver function					
Alkaline phosphatase (IU/L)	169.07±34.1	165.44±20.5	169.07±15.7	165.98±40.9	±26.12
AST (U/ml)	27.67±5.4	28.67±0.3	26.33±1.5	26.00±0.6	±2.80
ALT (U /ml)	30.33±5.5	36.00±2.1	36.67±4.6	35.00±1.2	±3.78

a, b and c: Means in the same row having different superscripts differ significantly (P<0.05)
SEM, standard error of the mean; AST: aspartic aminotransferase; ALT: alanine aminotransferase.

Caecum activity:

Caecum P^{H}, ammonia-nitrogen and TVFA,s concentration are shown in Table (6). Mean values of P^{H}, NH3-N and TVFA,s were not affected by levels of caraway seeds sieving in diets. In this respect, these results agreement with Moheghi *et al.* (2010).

Table (6): parameters caecum of the dietary diets

Item	Experimental diet			
	D_1	D_2	D_3	D_4
Nutrient digestibility				
PH	6.42 ±0.1	6.22±0.3	6.41±0.5	6.30±0.1
Ammonia -N	24.13±3.6	26.04±7.4	27.94±0.7	30.15±3.2
TVF,s	9.95±0.1	10.15±0.1	10.44±0.1	10.95±0.1

Body weight, feed intake and feed conversion ratio each growth weekly:

Results of body weight is given in Table (7). The first period (6-9) weeks, the body weight gains insignificant increased by supplemented anise levels in growing rabbit diets the highest insignificant increased body weight gain recorded with rabbits fed anise leaves D4 (6g/kg) feed by 15.57%, followed by those fed 4g/ kg by 12.00%, finally those fed 2g/ kg feed by 10.72%. Whereas, the feed intake was significant (P<0.05) increase between different diets, the highly significant feed intake recorded with control diet, followed D2 and D4, but the lowest values feed intake recorded with diet (D3). The feed conversion ratio was significantly (P<0.05) decreased with levels anise feed and the lowest FCR recorded

with D3 decreased from 3.66 to 2.67. The performance index was significantly increased in all anise leaves diets D4, D3 and D6% by 97.95, 39.86 and 34.40%, respectively compared with control 35.05%. The second period (10-13) weeks old was significantly (P<0.05) higher body weight gain was recorded with diet (D4) received fed anise leaves 6 g/kg feed as compared to control diet (D1). The final body weight in second period the highest increased was recorded with D4 from 1756.67 to 2348.44 gm, followed D3 1922.08gm.

Table (7): Productive performance of the rabbits fed the experimental diets.

Item	Experimental diet				± Std.E
	D_1	D_2	D_3	D_4	
First period (6-9 weeks old):					
IBW(g)	650.67± 21.7	651.17 ±5.53	653.67±3.71	657.81 ±6.66	±11.83
FBW(g)	1273.33±35.97	1409.87±49.73	1426.25 ±39.34	1471.53 ±113.9	±67.64
BWG(g)	622.66± 33.49	758.7 ±46.32	772.58±35.87	813.72 ±115.2	±66.76
Feed intake(g)	2268^{a} ± 0.1	2192^{b} ±0.2	2068^{c} ±0.21	1764^{d} ±0.31	±3.41
FCR	3.66b±0.20	2.91^{ab} ±0.18	2.69^{b} ±0.12	2.67^{a} ±0.36	±1.01
Performance index %	35.05^{b} ±2.78	49.02^{ab} ±4.69	53.43^{ab} ±3.94	69.38^{a} ±14.45	
Second period (10-13 weeks old):					
IBW	1273.33±35.97	1409.9±49.7	1426.25 ±39.34	1471.53 ±113.9	±67.64
FBW	1756.67^{d}±3.38	1816^{c} ±13.8	1922.08^{b}±29.76	2348.44^{a} ±14.6	±18.04
BWG	483.33^{b}±34.16	406.13^{b} ±51.0	495.83^{b} ±13.41	876.9^{a} ±127.1	±70.89
Feed intake	2609^{d}±0.1	3012^{a}± 0.23	2652^{b}±0.11	2648^{c} ±0.24	±15.04
FCR	5.47^{b} ±0.41	7.64^{a} ±0.87	5.36^{b} ±0.14	3.15^{c} ±0.45	±0.74
Performance index %	32.54^{b} ±2.27	24.50^{b} ±3.13	35.92^{b} ±3.94	77.90^{a} ± 11.71	
Whole period (6-13 weeks old):					
IBW	650.66 ±21.7	651.17 ±5.53	653.77 ±3.71	657.81 ±6.7	±11.83
FBW	1756.67^{d} ± 3.4	1816^{c} ±13.84	1922.08^{b} ±29.76	2348.44^{a} ±14.6	±18.04
BWG	1106^{c} ±23.63	1164.83^{c}±18.25	1268.42^{b} ±26.06	1690.63^{a} ±17.79	±21.72
ADG	19.75^{c} ±.85	20.80^{c} ±1.96	22.65^{b} ±2.53	30.18^{a} ±2.47	±2.01
Total feed intake	4827^{a} ±0.15	4647.20^{b} ±0.13	4395.20^{c} ±0.13	4385.72^{d}±0.21	±13.52
FCR	4.37^{a} ±0.09	3.997^{b} ±0.7	3.47^{c} ±0.07	2.59^{d} ± 0.03	±0.13
Mortality rate	2	2	0	0	

a, b, c and d: Means in the same row having different superscripts differ significantly (P<0.05).

Results of whole period (6-13) weeks, of final body weight, body weight gain, total feed intake and feed conversion ratio was significant (P<0.05) difference. The inclusion of anise leaves in rabbits' diets significantly (P<0.05) enhanced the body weight and the body weight gain compared to the control diet. The D4 with the highest level of anise seeds (6%) showed significantly (P<0.05) increase in the final body weight, average daily gain and total feed intake and enhanced FCR values compared to control D1. Bayram et.al. (2007) found that when anise seeds were added 10% and 20% to quail diets, feed intake increased. Zeweil *et. al.*(2015) showed that the final weight increased in diets containing anise seeds 7.98%, total weight gain by 10.9% and weekly gain increased by 10.92%, weekly feed intake 4.14%, FCR 5.96%, PI 14.84% compared to control the different feed additives significantly ($P \leq 0.01$) improved final body weight, body weight gain, feed intake, feed conversion ratio and performance index as compared to the control group. These improvement in all parameters may be related to active ingredient such as anethole which achieved through stimulating effect on digestive tract. Moreover, anise considered as natural growth promoter, obtain high gain with feeding 400 mg/kg anise oil to broiler, (Ciftci, *et al.*, 2005). (Cabuk *et al.*, 2003) revealed that the total feed intake was significant (p<0.05) positive effect on feed intake with increasing level of anise, this may be attributed to the enhancement of palatability.

Safa (2014) that, the diet with 1% anise seeds powder in broiler diets had significantly (P<0.05) heaviest body weight gain, highest feed intake, best feed conversion ratio. The highest feed intake was significantly (P<0.05) produced by the birds fed with the highest level of anise seeds powder diet (1%). (Cabuk *et al.*, 2003) and Al-Kassie (2008) reported that, this improvement in feed intake for the diet with 1% anise seeds powder may be attributed to the appetizing effect of active ingredient, such as anethol in anise. Similar result was obtained by Hamodi and Al-Khalani (2011) mentioned that supplementation of

anise seed at 6 kg/ton in broiler chick Cobb diet significantly (P<0.05) increased the feed consumption as compared with control diet. On the other hand, Christaki *et al.,* (2011) mentioned that, there were no differences in daily feed intake between the dietary treatments over the experimental period the percent

anise leaves 10% and 20% of commercial laying diet. In addition to, several researchers reported that anise oil significantly improved the feed conversion ratio of broiler chickens (Ather, 2000; Williams and Losa, 2001; Giannenas *et al.,* 2003; Ciftci *et al.,* 2005). Moreover, the improvement effects of using anise seeds in broiler diet might be due to the improvement of apparent whole tract and ileal digestibility of the nutrients (Hernandez *et al.,* 2004), increasing the effects of pancreatic lipase and amylase secretion (Ramakrishna et al., 2003), the positive effect of anise seeds powder in broiler diets on the final body weight, body weight gain and feed conversion ratio can be explained by the fact that, anise have medical. In this study, feeding 2% to 6% anise leaves to rabbits reduced feed intake by 22.22% from 6-9 weeks and 2.61% from 10 – 13 weeks are showed in Table (7). Zeweil, *et al.,* (2015) showed that the final weight increased in rations containing anise seeds 7.98%, total weight gain by 10.9% and weekly gain increased by 10.92%, weekly feed intake 4.14%, FCR 5.96%, PI 14.84% compared to control. The different levels anis leaves were significantly ($P \leq 0.01$) improved final body weight, body weight gain, feed intake, feed conversion ratio and performance index as compared to the control group.

Carcass characteristics:

Results presented in Table (8) showed the effect of anise leaves on carcass traits. Including different levels anise leaves in the rabbit diets resulted in increasing absolute carcass weight. Results of carcass weight were in harmony with final live body weight However, the results showed no significant differences were observed in total giblet, lung and kidney as compared to the control group. Results illustrated in Table (8) indicated that the non-edible part and edible parts were significantly ($P \leq 0.01$) increased due to different anise leaves containing rations compared to the control diet. The results presented by Hamodi and Al-Khalani (2011) found an increase in carcass dressing percentage, liver, heart and gizzard of broilers fed anise containing diet.

Table (8): The effect of anise leaves on carcass characteristics.

Item	Experimental diet				± Std.E
	D1	D2	D3	D4	
Slaughter weight (g)	1756.7^{a}± 3.4	1828^{b}±2.1	1922^{c}±29.8	2348.3^{d}±14.5	±16.7
Blood (g)	51.67±1.7	51.7±1.7	56.67±1.7	62±6.7	±3.63
carcass weight (g)	985.67^{c}±11.5	1108.67^{b}±35.3	1154.33^{b}±32.1	1597^{a}±7.0	±24.76
Non-Edible parts%	264.67^{b}±6.4	273.33^{b}±7.5	285.33^{b}±5.0	370^{a}±13.3	±8.64
Fur %	349.33^{b}±7.6	403^{ab}±40.1	425.33^{a}±7.2	416.00^{ab}±4.4	±20.84
Head %	107.67^{c}±0.9	109.67^{c}± 2.7	128^{b}± 2.9	143.67^{a}± 2.4	±2.36
Liver%	2.37^{c}±0.6	2.43^{bc} ±2.4	2.69^{ab} ±0.03	2.71^{a}±0.1	±0.08
Heart %	0.32^{b}±0.01	0.33^{ab} ±0.01	0.35^{ab} ±0.01	$0.36^{a\pm}$0.01	±0.011
Kidney%	1.04±0.02	1.04±0.1	1.05±0.1	1.07±0.1	±0.07
Lung%	0.58±0.01	0.59±0.01	0.61±0.0	0.62±0.6	±0.06
Spleen%	0.13^{b}±0.0	0.14^{ab}±0.01	0.17^{ab}±0.1	0.19^{a}±0.01	±0.01
Testes%	0.27^{b}±0.02	0.27^{b}±0.01	0.28^{b}±0.01	0.34^{a}±0.02	±0.023
Total Giblets%	4.13±0.1	4.21±0.3	4.54±0.2	4.67±0.01	±0.198

a, b, c and d: Means in the same row having different superscripts differ significantly (P<0.0001).

Nitrogen balance of rations:

Data of Table (9) cleared that dietary no significant effect on nitrogen intake, nitrogen balance, nitrogen absorption and NB/ N. absorption but fecal nitrogen, urinary nitrogen and total nitrogen extraction had significant ((P<0.05) decrease with increase leaves anise percent in diets. NB/NI has significant increased by increase levels anise leaves.

Phytochemicals of the anise leaves:

Phytochemicals of the anise leaves are shown in Table (10). The major constituent of anise leaves is anethole 0.44mg/L, the total antioxidant capacity mg/100g (ascorbic acid equivalent) is 369.48.and the total phenols mg/100g (garlic acid equivalent) is 193.11. The anise seed compounds possess potent

antimicrobial properties that prevent infections and block the growth of fungi and bacteria. Anethole has potent antimicrobial properties, against bacteria, yeasts, and fungi (De, M. *et al.* 2002). Total phenolics, in anise seed was 46.17 (mg GAE /100g dw). Beside antioxidant capacity, phenolic compounds exhibit a wide range of biological activities, including anti-carcinogenic, anti-inflammatory, anti-viral, anti-allergic, estrogenic, immune-stimulating agents, antiallergenic, anti-artherogenic, antiinflammatory, anti-microbial, antithrombotic, antistress, antihyperglycemic, cardioprotective and vasodilatory effects (Tawaha K. *et al.*, 2007).

Table (9): Nitrogen balance of dietary rations.

Item	Experimental diets				± Std.E
	D_1	D_2	D_3	D_4	
Feed nitrogen (g)	3.48±0.3	3.24±0.3	2.96±0.0	3.02±0.1	±0.22
Nitrogen excrete (g):					
Feces nitrogen (g)	0.96^{a}±0.1	0.88^{ab}±0.2	0.68^{ab}±0.0	0.58^{b} ±0.0	±0.10
urine nitrogen (g)	0.29^{a}±0.1	0.28^{a}±0.0	0.18^{ab}±0.0	0.15^{b}±0.0	±0.04
Total nitrogen excretes (g)	1.24^{a}±0.1	1.15^{ab}±0.2	0.86^{bc}±0.0	0.74^{c}±0.0	±0.10
Nitrogen balance (g)	2.53±0.2	2.37±0.2	2.27±0.1	2.44±0.1	±0.16
Nitrogen absorption (g)	2.24±0.3	2.096±0.2	2.1±0.1	2.29±0.1	±0.19
NB / N. absorption	1.139±0.0	1.138±0.0	1.084±0.0	1.067±0.0	±0.027
NB / NI	0.638^{b}±0.0	0.647^{b}±0.0	0.71^{ab}±0.0	0.75^{a}±0.0	±0.028

a, b and c: Means in the same row having different superscripts differ significantly (P<0.05).

Table (10): phytochemicals evaluation of the anise leaves.

Phytochemical		anise leave
Total antioxidant capacity	mg/100g (ascorbic acid equivalent)	369.48
Total phenols	mg/100g (garlic acid equivalent)	193.11
anethol	mg/L	0.44

Economical evaluation:

Results in Table (11) showed that, the using anise leaves in rabbit diets the cost of one kg feed, (LE)

Table (11): Economical evaluation of the experimental groups.

Item	D1	D2	D3	D4
Marketing weight, Kg	1.757^{d} ±3.38	1.816^{c} ±13.8	1.922^{b} ± 29.76	2.348^{a} ± 14.6
Feed consumed (as it is, kg)/rabbit,	4.83^{a} ±0.15	4.65^{b} ±0.13	4.40^{c} ±0.13	4.39^{d}±0.21
Feed consumed (feed/day/rabbit) gm	86.20	82.99	78.49	78.32
Costing of one kg feed, (LE)1	5.50	5.49	5.48	5.50
Total feed cost, (LE)	26.57	25.53	24.11	24.15
Management/ Rabbit, (LE)	30.00	30.00	30.00	30.00
Total cost, (LE)2	56.57	55.53	54.11	54.15
Total revenue, (LE)3	79.05	81.72	86.493	105.68
Net revenue	22.48	26.19	32.38	51.54
Economical efficiency4	0.397	0.472	0.598	0.952
Relative economic efficiency5	100	118.89	150.73	239.73
Feed cost / kg LBW (LE)6	15.12	14.06	12.40	10.29

*1 Based on prices of year 2018. 2 include the feed cost of experimental rabbit which was LE 30/ rabbit + management. 3 Body weight x price of one kg at selling which was LE 45. 4 net revenue per unit of total cost. 5 Assuming that the relative economic efficiency of control diet equal 100. 6 Feed cost/kg LBW = feed intake * price of kg / Live weight*

was decreased by inclusion anise leaves in test rations compared to control diet. However, decreasing feed consumed by rabbits compared to control, but marketing weight were increased by diets containing anise leaves, this reason related to increase marketing weight. Diets containing anise leaves improved total cost, total revenue, net revenue, economic efficiency, relative economic efficiency, and feed cost / kg LBW. Rabbits received R4 which content 6% anise leaves recorded the best total cost, total revenue, net revenue, economic efficiency, relative economic efficiency, and feed cost /Kg LBW (LE).

CONCLUSION

It can be concluded that adding anise leaves in diets up to 6% improved nutrient digestibility, nutritive values, feeding values, final body weight, average daily gain, feed conversion ratio and carcass weight as well as realized of relative economic efficiency.

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استخدام اوراق اليانسون *(Pimpinella Anisum L.)* فى تحسين أداء الارانب النيوزيلندي

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المركز الاقليمى للاغذية والاعلاف- مركز البحوث الزراعية – جيزة – مصر.

تم توزيع ستة وثلاثين من الأرانب النيوزيلندية المختلطة (5-6 أسابيع ومتوسط الوزن 654.64 ± 2.75 جم بشكل عشوائي في 4 مجموعات (9 لكل منها في 3 مكررات. تم تغذية الأرانب التجريبية على نظام غذائي أساسي يحتوي على أوراق اليانسون (*Pimpinella Anisum L.)* بالمستويات 0 و 2 و 4 و 6٪ للمجموعات الارانب التجريبية ، وقد تمت صياغة جميع الوجبات الغذائية التجريبية لتلبية متطلبات المغذيات للأرانب وفقًا لـ (NRC 1977). استمرت فترة التغذية 56 يومًا. سجلت العلائق الغذائية التي تحتوي على مستويات مختلفة من أوراق اليانسون (D2 و D3 و D4٪) هي الأعلى ($P < 0.05$) بشكل كبير في معامل هضم كل من المادة الجافة(DM%) والمادة العضوية (OM%) والبروتين الخام (CP%)، اعلى قيم هضمية سجلت مع العليقة (D4) بحوالى 19.29 و 25.42 و 19.81 ٪، على التوالى. يلية العليقة (D3) بنسبة 11.50 و 7.79 و 14.07٪ ، وأخيرًا العليقة (D2) بنسبة 10.35 و 4.11 و 15.16٪ مقارنة بالنظام الغذائي المضبوط (D1) الذي قيمته 64.90 و 64.74 و 67.14٪ على التوالي. لايوجد اى اختلاف معنوى لمعامل هضم الدهن الخام بين العلائق الغذائية المختبرة . خلاف ذلك ، العليقة الغذائية D2 التى تحتوى على أوراق الينسون بنسبة 2 ٪ انخفض معامل هضم الالياف الخام معنويا ($P < 0.05$) حوالى 6.51 ٪ ، ولكن ارتفع معامل هضم الالياف بالعليقة الغذائية (D3) بشكل ملحوظ بحوالى 82.70 ٪ ، وسجلت أعلى القيم لمعامل هضم الالياف مع العليقة (D4) بحوالى 214.32٪. معامل هضم NDF، ADF، الهيميسلسلوز والسيليلوز ، NDF-cell soluble يميلوا إلى أن يكونوا اعلى زيادة مع العليقة (D4)، تليها (D3) مقارنة مع عليقة الكنترول. أخيرًا ، تم تسجيل أفضل نتيجة مع العليقة الغذائية (D4) التي تحتوي على أوراق اليانسون بنسبة 6٪. كانت القيم الغذائية (TDN ، DCPو DE)أعلى زيادة معنوية مع العليقة الغذائية (D4) بحوالى 16.42٪ ، 25.88 ٪و 21.64 (كيلو كالورى /كجم مادة جافة) ، على التوالي ، تليها العليقة (D2) بحوالى 14.04 ٪ ، 15.35 ٪ و 10.62(كيلو كالورى /كجم مادة جافة). بينما أقل قيمة غذائية سجلت مع العليقة الغذائية (D3) بحوالى 20.19 ٪ و 16.42٪ و 13.21(كيلو كالورى /كجم مادة جافة) ، على التوالي .مكونات بلازما الدم في العلائق الغذائية لا تتأثر بشكل كبير بأوراق اليانسون لكل من البروتين الكلي ، الألبومين ، الجلوبيولين ، الدهون (الكوليسترول الكلي ، الكوليسترول المنخفض الكثافة ، الكوليسترول الحميد ، الدهون الثلاثية) ، وظائف الكلى (اليوريا ، الكرياتينين) ووظائف الكبد الفوسفاتيز القلوية ، (ASTو ALT) للبلازما . اضافة أوراق اليانسون في علائق الأرانب زادت بشكل معنوى ملحوظ ($P < 0.05$) فى وزن الجسم ومعدل الزيادة الوزنية للجسم بالمقارنة مع عليقة الكنترول. أظهرت عليقة D4 التى تحتوى على أعلى مستوى من ورق اليانسون (6 ٪) بشكل معنوى ملحوظ ($P < 0.05$) أعلى وزن نهائي في الجسم ، ومعدل الزيادة الوزنية والغذاء الكلي الماكول مع أفضل انخفاض FCR والكفاءة الاقتصادية بالمقارنة مع عليقة الكنترول(D1). أظهرت النتائج عدم وجود فروق ذات دلالة إحصائية في الأحشاء الداخلية الماكولة الكليه والرئة والكلى مقارنة بمجموعة الكنترول. أظهرت الخصية زيادة معنوية كبيرة بسبب اتباع نظام غذائي يحتوي على أوراق اليانسون والتي قد تكون ناجمة عن تأثير الينسون فيتواستروجين. ادى الى انخفاض قيمة تكلفة التغذية / كجم وزن الجسم الحي للعلائق التى تحتوى على أوراق اليانسون مقارنة بعلائق الكنترول . الملخص ان استخدام اوراق الينسون فى علائق الارانب ممكن ان تصل الى 6% تؤدى الى تحسن فى المواد الغذائية وقيم التغذية و كما أدركت معايير النمو أعلى قيمة لكفاءة الأعلاف والكفاءة الاقتصادية النسبية.

التحسن في الزيادة الوزنية للجسم في المعاملات التي مضاف اليها أوراق اليانسون في العلائق الغذائية مقارنةً بالمقارنة بمجموعة الكنترول. ربما قد يرجع الى ارتباطًا بالعنصر النشط مثل الأنثول الذي يتحقق من خلال التأثير المنبه على الجهاز الهضمي.. استخدام أوراق نبات الينسون الطبية *(Pimpinella anisum L.)* كمادة مضافة في علائق الأرانب، ادى الى وانخفاض قيمة تكلفة التغذية / كجم وزن الجسم الحي للعلائق التى تحتوى على أوراق اليانسون مقارنة بعلائق الكنترول . الملخص: في هذه الدراسة ، يمكن أن نخلص إلى أن إضافة أوراق اليانسون بنسبة 6 ٪ كإضافات اعلاف ادى الى تحسين المواد الغذائية والقيم الغذائية ،وقياسات النمو وكذلك أدركت أعلى قيمة للكفاءة الاقتصادية النسبية وانخفاض قيمة تكلفة التغذية / كجم وزن الجسم الحي. أيضا ، يمكن اعتبار النباتات الطبية المستخدمة بمثابة منشط للنمو فعال في تحسين استخدام العلائق.