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EFFECT OF INCORPORATING DRIED CARROT PROCESSING WASTE IN GROWING RABBIT DIETS

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SUMMARY

A total number of sixty mixed sex Rex weaned rabbits at six weeks old with an average intial body weight of 827.7± 79 were used to study the effects of using dried carrot waste(DCW) at different levels on growth performance, digestibility of nutrients, blood parameters, carcass traits and economic traits. Rabbits were randomly assigned to four experimental groups of fifteen rabbits with five replicates of three animals each. The first group was fed the control diet without DCW while the second, third and fourth groups were fed diets containing 25, 50 and 75% DCW, respectively.The results indicated that using carrot waste (DCW) at the level of 50.0% gave insignificant increase of body weight (BW) and daily weight gain(DWG) compared with either 25% DCW or control diet at 10 and 14 weeks of age.However, rabbits fed 75% DCW recorded significant decrease in BW and DWG compared with those recived 50% DCW diet. Daily feed consumption and feed conversion ratio were not significantly affected by using DCW up to 50%. during the whole experimental period. There was a significant improvement of DM, OM, CP and CF digestion coefficients and digestible crude protein by using 50% DCW diet compared with the other experimental diets .However, EE , NFE and TDN recorded the lowest values in the group received 75% DCW diet compared with the other groups. There were no significant differences between the DCW dietary treatments and control group in carcass characteristics. Serum proteins and albumin levels were significantly increased while Serum glucose, urea-N and GPT levels were decreased for rabbits receiving different levels of DCW compared with control one. Serum total lipids,cholestrol and globulin levels were not significantly differ among different treatments. Animals fed 75% DCW diet gave lower serum GOT than those fed the other dietary treatments. Using DCW in rabbit diets decreased the total cost of the diets by 9.5, 22 and 43.3 % compared with the cost of control diet. Using DCW at the level of 50% improved the economic efficiency and relative economic efficiency values than those received either 25% DCW or control diets.

In conclusion, the results indicated that dried carrot waste could be used up to 50% in growing rabbit diets in place of the most conventional ingredients used in this experiment without any adverse effects on productive performance, nutrients digestibility, blood components and economical efficiencey.

***Keywords**: rabbit, carrot waste, performance, digestibility, carcass, blood components.*

INTRODUCTION

As it is commonly known, feeding is the main factor that affects rabbits production. However, feeding cost for rabbits is considered to be the most expensive item since it represents about 60-65% of the total production cost. In Egypt, there is a serious problem of feed shortage for animal field and also a continuous increase in the prices of the conventional feed ingredients. Incorporation of cheap unconventional feedstuffs in the rabbit diets may participate in solving the problem of feed shortage, decrease the feeding cost and alleviate the pollution problems. Food processing wastes are the end products of dietary value of the food processing industries which can not be recycled or used for other purposes. These are the non-product flows of raw materials whose economic values are less than the cost of collection and recovery for reuse; and therefore discard as a waste. These wastes pose increasing disposal and potential severe pollution problems and represent a loss of valuable biomass and nutrients (Shrivastva and Kumar, 2005) The composition of wastes emerging from food processing industries is extremely varied and depend both on nature of the product as well as the production techniques employed. The wastes will be considered valuable, if the value of derived products from these wastes exceed the cost of reprocessing.

Carrots are rather inexpensive and highly nutritious as it contains appreciable amount of vitamins B_1, B_2, B_6 and B_{12} besides being rich in carotene (Manjunatha et al., 2003). High carotenoid intake is associated with lowering risk of many cancers, especially the prostate cancer. Further, vitamin A is an antioxidant which is a key to the growth and repair of tissues and helps the body to fight with infections, keep eyes healthy, nourish epithelial tissues in the lungs, as well as of the skin. Therefore, maximum retention of □–carotene is of utmost importance for the preservation of the attractive appearance and dietary value of the product. A part from being high in carotenoids, carrots are also high in dietary fiber (Bao. and Chang, 1994). Furthermore, degradation products of pectin (oligogalacturonic acids, OGAs) which found in carrot have been reported to inhibit bacterial adherence to epithelial cells and show potential for the treatment of infectious diseases (Schweiggert et al., 2004). Carrots also contain a significant supply of calcium, potassium and phosphorus. Carrots are also a good source of energy because it contains a lot of sucrose. This low cost crop could be converted to a value added products, if processed properly and decrease the environmental load. Juice yield is reported to be only 60-70% and up to 80% of the carotene may be lost with the pomace. Total □-carotene content of pomace may be up to 2 g per kg dry matter, depending on processing conditions.

findings of Sikder et al. (1998) reported that body weight gain and feed conversion of laying hens were not significantly affected due to dietary addition of dried carrot meal (DCM) and no mortality was observed during the experimental period. On the other hand, Sakhawat et al.(1992) reported that Hubbard broilers fed on diets containing sun-dried carrot residue up to

12% had no significant differences in weight gain, feed intake and feed conversion efficiency. However, the studies of using carrot waste in rabbit diets are limited.

The present study was designed to evaluate the possibility of incorporating different levels of carrot waste in growing rabbit diets and its effects on growth performance, digestibility of nutrients, blood parameters, carcass traits and economical evaluation.

MATERIALS AND METHODS

This work was carried out at the Center of Agriculture Studies and Consultations (CASC), Rabbit Production Unit, Faculty of Agriculture, Ain Shams University, Cairo, Egypt. Fresh carrot waste used in this experiment was obtained from Montana Company, air dried , finely ground and thorougly homogenized before mixing with the other ingredients of the experimental diets.

A total number of sixty, unsexed, Rex weaned rabbits, (6 weeks old) were randomly divided into four experimental groups (15 rabbits/group). Each group was subdivided into five replicates of 3 rabbits. Initial body weights of all groups were almost equal. Four pelleted experimental diets were formulated to be approximately isocaloric, isonitrogenous and isofibrous in which dried carrot waste (DCW) was incorporated at levels of 0, 25, 50 and 75%. All experimental diets were formulated at Atmida company to meet the recommended nutrient requirements of rabbits according to NRC (1977) and Cheeke (1987). The rabbits were housed in galvanized metal wire cages provided with feeders and automatic drinking system and were kept under the same managerial and hygienic conditions. The experimental period was extended for 8 weeks. Ingredients and chemical composition of the basal diet as well as the experimental diets are presented in Table (1).

Individual live body weight and feed consumption were recorded at weekly intervals during the experimental period (6-14weeks of age). At 14 week of age, a digestibility trial was carried out. The animals (5 males /experimental group) were housed individually in metabolic cages for 7 days as a preliminary period and 5 days as a collection period. Amounts of feed were offered and feces of each animal were taken daily during the collection period. The analysis of dried carrot waste (DCW), the experimental diets and feces were carried out according to A.O.A.C (1996). Dreid carrot waste was analyzed for fiber fractions, being neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) using Tecator Fibretic System according to Goering and Van Soest (1970) procedures. Hemicellulose was calculated as the difference between NDF and ADF, while cellulose was calculated as the difference between ADF and ADL. Amino acids concentrations were measured using a Bekman 7300 High Performance Amino Acids Analyzer according to the methods of AOAC (1996) at the CLFF, Agriculture Research Center, Giza, Egypt. The total digestible nutrients (TDN) was calculated according to the classic

Table (1): Composition and chemical analysis of the experimental diets.

Ingredients (%)	Levels of dietary dried carrot waste (DCW), %			
	0.0	25.0	50.0	75.0
Clover hay	29.00	21.00	13.20	5.00
Barley	21.00	15.50	9.50	2.00
Yellow corn	5.00	3.60	2.20	2.00
Wheat bran	26.30	19.00	12.00	5.00
Carrot waste	-	25.00	50.00	75.00
Soybean meal (44% CP)	16.00	11.62	7.50	3.50
Vegetable oil	0.25	1.65	2.80	4.15
Limestone	1.00	0.90	0.72	0.70
Dicalcium phosphate	0.80	1.00	1.25	1.60
Premix*	0.30	0.30	0.30	0.30
Common salt (NaCl)	0.25	0.25	0.25	0.25
DL-Methionine	0.10	0.18	0.23	0.30
Lysine	0.00	0.00	0.05	0.25
Total	100.00	100.00	100.00	100.00
Chemical analysis (as fed basis)				
A- Determined analysis: -				
Dry matter (DM%)	92.00	91.88	90.44	90.34
Organic matter (OM%)	84.00	82.98	81.50	81.00
Crude protein (CP%)	16.93	16.82	16.79	16.77
Crude fiber (CF%)	13.95	13.67	13.22	12.60
Ether extract (EE%)	2.76	4.03	5.15	6.6.2
Nitrogen free extract (NFE%)	50.36	48.46	46.34	51.63
Crude ash (%)	8.00	8.82	8.94	9.34
B- Calculated analysis:-				
DE (kcal/kg)	2541	2531	2509	2507
Methionine + cystine (%)	0.68	0.68	0.65	0.65
Lysine (%)	0.96	0.77	0.65	0.65
Calcium (%)	1.06	1.03	1.00	1.02
Total phosphorous (%)	0.64	0.62	0.60	0.61
Price (L.E./ton)	1499	1394	1171	941

* Each Kilogram of premix provides: 2000.000 IU vit. A, 150.000 IU vit. D, 8.33g vit. E, 0.33g vit K, 0.33g vit. B1, 1.0g vit. B2, 0.33g vit. B6, 8.33g vit. B5, 1.7 mg vit. B12, 3.33g Pantothenic acid, 33mg Biotin, 0.83g Folic acid, 200g Choline chloride, 11.7g Zn, 12.5g Fe, 16.6 mg Se, 16.6 mg Co, 66.7g Mg and 5g Mn.

formula (Cheeke et al., 1982) as following:

TDN = DCP + DCF + DNFE + (DEE × 2.25)

Where: DCP = Digestible Crude Protein, DEE = Digestible Ether Extract, DCF = Digestible Crude Fiber, DNFE = Digestible NFE

Blood samples were collected from the experimental groups (5 rabbits/ group) at the end of the experiment. The blood samples were collected inheparinized tubes and centrifuged at a speed of 3000 rpm for 15 minutes and blood serum was stored frozen till biochemical analysis. Total proteins, albumin, glucose, total lipids, total cholesterol, urea-N, transaminase enzymes activities (GOT and GPT) were determined in the blood serum colorimetrically using available commercial kits purchased from Diamond Diagnostics Company, Egypt. The globulin values were obtained by subtracting the values of albumin from the corresponding values of total proteins. After complete bleeding of rabbits, pelt, viscera and tail were removed, then carcass, giblets, (liver, heart, kidney) were weighed. Dressing percentage included relative weights of carcass, giblets and head.

The economical efficiency (EEf) was calculated according to the following equation: EEf = A-B/B X 100 Where A is selling cost of obtained gain (LE per kg) and B is the feeding cost of this gain. The performance index (PI) was calculated according to the equation described by North (1981) as follows:

PI = Live body weight (Kg) x 100/ Feed conversion

Data were statistically analyzed by using SAS program (SAS, 1998). According to the following model. $Y_{ij} = \mu + T_i + e_{ij}$ Where: Y_{ij} = The observation on the I^{th} treatment, μ = Overall mean, T_i = Effect of the I^{th} treatment, e_{ij} = Random error treatment. Duncan's Multiple Range Test was also used for the comparison among means of the experimental groups (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical analysis of dried carrot waste (DCW) :

The proximate analysis of DCW is presented in Table (2). It is shown that, the DCW has reasonable amounts of protein and carbohydrates (nitrogen free extract and crude fiber). Moderate amounts of ash and low amount of EE were also found. The nutritive value of DCW is within the results reported by Sikder et al. (1998) who found that Dried carrot meal prepared from fresh carrot was found to be a moderate source of protein (18.83 %) and energy (2510 kcal/kg) with low level of fibre (8 %), while DM, EE and NFE content were 89.5, 3.5 and 66.17 %, respectively. The results indicated also that values of cell wall constituents of DCW used in this study were low compared with those in clover hay and wheat bran used in diets of this experiment. The results of amino acid contents (%) shown in Table (2), indicated that DCW used in this study were poor in the essential amino acids while, it rich in alanine and glutamic acid.

Table (2): Composition and chemical analysis of the dried carrot waste.

A- Proximal analysis (%)		C- Amino acid contents (%)	
Dry matter (DM%)	90.25	Methionine	0.14
Organic matter (OM%)	79.20	Cystine	0.18
Crude protein (CP%)	18.00	Lysine	0.29
Crude fiber (CF%)	13.50	Theronine	0.28
Ether extract (EE%)	1.77	Arginine	0.29
Nitrogen free extract (NFE%)	45.93	Isoleucine	0.37
Crude ash (%)	11.05	Leucine	0.48
DE (kcal/kg)*	2217	Valine	0.53
		Histidine	0.26
B- Fiber fractions (%)		Phenylalanine	0.23
		Glycine	0.46
NDF	27.92	Serine	0.31
ADF	14.29	Alanine	1.26
ADL	1.27	Aspartic acid	0.66
Hemicellulose	13.63	Glutamic acid	0.92
Cellulose	13.02	Proline	0.33

* The digestible energy (DE) was calculated according to **Fekete and Gippert (1986)** by applying the equation
DE (kcal/kg) = 4253-32.6 (CF %) -144.4 (total ash %).

Productive Performance:

The data presented in Table (3) showed that using dried carrot waste (DCW) at the level of 50.0% gave insignificant increase of LBW and DWG compared with either those fed control or 25.0% DCW diets at 10 and 14 weeks of age. Although rabbits fed 75.0% DCW recorded significant decrease in BW and DWG compared with those recived 50% DCW diet during the same experimental periods mentioned above. In the same trend, daily feed consumption and feed conversion ratio were not significantly affected by using DCW up to 50% compared with control group, while feeding rabbits DCW diet at the level of 75% gave significantly the worst values during the whole experimental period. It is interesting to notice that, the morality rate during all the experimental period of growth was within the normal range among treatments. This may be an indication that growing rabbits can tolerate different dietary levels of DCW used in this study.

These results agree with the findings of Sikder et al. (1998) who reported that body weight gain and feed conversion of laying hens were not significantly affected due to dietary addition of dried carrot meal (DCM) and no mortality was observed during the experimental period. However, Sakhawat et al. (1992) reported that Hubbard broilers fed diets containing sun-dried carrot residue up to 12% had no significant differences in weight gain, feed intake and feed conversion efficiency. The results reported herein indicated that DCW could be used up to 50% as a substitute of the most ingredients in this experiment without any deleterous effect on productive performance. Also, DCW contains some essential nutrients like vitamins B_1, B_2, B_6 and B_{12} besides being rich in carotene (Manjunatha et al., 2003) effect as an antioxidant, oligogalacturonic acids as inhibitor to bacterial adherence to epithelial cells and its potential effect for the treatment of infectious diseases, significant supply of calcium, potassium and phosphorus and also a good source of energy (Schweiggert et al., 2004).

Nutrients digestibility and nutritive values:

Digestion coefficients of nutrients and nutritive values of the experimental diets are presented in Table (4). The results indicated that there were significant improvement of DM, OM, CP and CF coefficients and DCP by using 50% DCW diet compared with the other experimental diets. On the other hand, digestibility of EE and NFE as well as the TDN recorded the lowest values in the group received 75% DCW diet compared with the other groups which gave similar values for the previous digestibility ones.

Carcass characteristics:

Carcass traits and dressing percentage results are shown in Table (5). The results indicated that, there were no significant differences between the levels of DCW used in this experiment and control group in all measurements of carcass characteristics. These results indicated that DCW could be incorporated in rabbit diets without adverse effects on carcass characteristic measurements.

These results were in harmony with those obtained by Sakhawat *et al.*

Table (3): Effect of feeding different levels of dried carrot waste (DCW) on productive performance of growing rabbits.

Item	Control	25%CW	50%CW	75%CW	Sig.
No. of rabbits	15	15	15	15	
		Live body weight (g)			
6 weeks	827.12 ±29.46	826.75 ±48.69	828.75 ±30.89	828.25 ±45.26	NS
10 weeks	1458.3^{ab} ±60.5	1468.8^{ab}±64.3	1528.0^{a} ±27.6	1328.5^{b} ±12.5	*
14 weeks	1997.3^{ab} ±84.9	2017.0^{ab}±16.7	2046.0^{a} ±24.3	1800.3^{b} ±19.7	*
		Daily weight gain (g)			
6-10 weeks	22.54^{a} ±1.16	22.92^{a} ±0.87	24.97^{a} ±0.62	17.86^{b} ±1.83	**
10-14 weeks	19.25 ±1.67	19.57 ±1.94	18.50 ±1.18	16.84 ±0.60	NS
6-14 weeks	20.89^{a} ±1.20	21.25^{a} ±1.24	21.73^{a} ±0.52	17.35^{b} ±0.72	*
		Daily feed consumption (g)			
6-10 weeks	79.90^{ab} ±2.66	75.67^{bc} ±1.60	85.49^{a} ±1.25	72.32^{c} ±2.13	**
10-14 weeks	93.41^{a} ±3.87	93.21^{a} ±1.60	87.48^{ab} ±2.95	84.12^{b} ±1.20	*
6-14 weeks	86.66^{a} ±2.99	84.44^{a} ±1.50	86.48^{a} ±1.07	78.22^{b} ±0.79	*
		Feed conversion ratio (g feed/ g gain)			
6-10 weeks	3.54^{b} ±0.08	3.30^{b} ±0.06	3.42^{b} ±0.04	4.05^{a} ±0.37	*
10-14 weeks	4.85 ±0.30	4.76 ±0.40	4.73 ±0.13	5.00 ±0.11	NS
6-14 weeks	4.15^{b} ±0.11	3.97^{b} ±0.17	3.98^{b} ±0.05	4.51^{a} ±0.17	*
		Survival number (%)			
6-14 weeks	13	14	15	14	

^{a,b} Means within the same row with different superscripts are significantly different, Sig. =Significance NS=Non Significant, * ($P \leq 0.05$), ** ($P \leq 0.01$).

Table (4): Effect of feeding different levels of dried carrot waste (DCW) on nutrients digestibility and nutritive values of growing rabbits.

Item	Control	25%CW	50%CW	75%CW	Sig.
		Digestion Coefficients:			
Dry matter (DM)	63.08^{b}±1.27	63.67^{b} ±0.72	70.78^{a} ±1.17	65.52^{b} ±1.35	**
Organic matter (OM)	65.65^{b} ±1.08	66.65^{b} ±0.79	72.23^{a} ±1.18	67.14^{b} ±1.19	**
Crude protein (CP)	75.91^{b} ±0.63	77.04^{b} ±1.25	80.53^{a} ±0.59	74.64^{b} ±1.29	**
Ether extract (EE)	77.58^{ab} ±2.42	78.86^{ab} ±0.58	81.15^{a} ±2.43	73.68^{b} ±2.26	*
Crude fiber (CF)	23.18^{c} ±3.49	33.74^{b} ±2.75	45.62^{a} ±2.10	31.06^{cb} ±3.04	**
Nitrogen free extract (NFE)	74.58^{a} ±0.78	75.34^{a} ±1.49	76.48^{a} ±1.12	65.36^{b} ±1.16	**
		Nutritive values (%):			
DCP	12.84^{b} ±0.10	13.09^{b} ±0.21	13.72^{a} ±0.10	12.77^{b} ±0.21	**
TDN	61.29^{a} ±0.78	61.92^{a} ±0.58	62.50^{a} ±0.94	53.96^{b} ±0.91	**

^{a,b} Means within the same row with different superscripts are significantly different, Sig. =Significance NS=Non Significant, * (P≤0.05), ** (P≤0.01).

Table (5): Effect of feeding different levels of dried carrot waste (DCW) on carcass traits of growing rabbits.

Item	Control	25%CW	50%CW	75%CW	Sig.
Dressing percentage	60.26±0.59	58.33±0.61	60.07±0.34	59.65±0.77	NS
Hot carcass (%)	49.85±0.55	48.37±0.81	49.48±0.26	48.74±0.95	NS
Giblets (%)	4.96±0.09	4.81±0.26	5.12±0.37	5.13±0.12	NS
Kidney (%)	0.67±0.07	0.63±0.02	0.67±0.02	0.72±0.05	NS
Kidney fat (%)	0.76^{ab}±0.15	0.53^{b}±0.10	0.93^{a}±0.05	0.89^{a}±0.05	*
Liver (%)	3.21±0.10	3.19±0.25	3.33±0.27	3.11±0.05	NS
Head (%)	5.44±0.29	5.14±0.24	5.27±0.20	5.78±0.27	NS
Heart (%)	0.31^{b}±0.01	0.44^{a}±0.04	0.37^{ab}±0.01	0.39^{ab}±0.02	*

^{a,b} Means within the same row with different superscripts are significantly different, Sig. =Significance NS=Non Significant, * (P≤0.05), ** (P≤0.01).

Table (6): Effect of feeding different levels of dried carrot waste (DCW) on blood constituents of growing rabbits.

Parameters	Control	25%CW	50%CW	75%CW	Sig.
Total proteins (g/dl)	6.45^{b}±0.31	7.13^{a}±0.16	7.31^{a}±0.12	7.12^{a}±0.12	*
Albumin (g/dl)	3.29^{b}±0.13	3.94^{a}±0.17	4.28^{a}±0.16	3.86^{a}±0.16	**
Globulin (g/dl)	3.16±0.19	3.19±0.16	3.03±0.11	3.26±0.06	NS
A / G ratio	1.05^{b}±0.03	1.25^{ab}±0.09	1.42^{a}±0.07	1.18^{ab}±0.07	*
Glucose (mg/dl)	158.2^{a}±9.1	108.8^{b}±8.4	99.8^{c}±2.3	123.43^{b}±10.7	**
Total Lipids (g/dl)	513.8±23.4	581.60±35.6	512.0±18.4	548.3±15.6	NS
Cholesterol (mg/dl)	152.3±3.0	155.0±1.48	162.2±2.4	160.2±3.4	NS
urea-N (mg/dl)	21.41^{a}±0.67	19.08^{a}±0.95	18.82^{b}±1.04	17.79^{b}±0.64	*
GOT (µ/l)	31.75^{b}±0.37	42.80^{a}±3.24	35.50^{b}±2.25	31.50^{b}±1.84	**
GPT (µ/l)	36.40^{a}±2.03	27.96^{b}±0.99	30.25^{b}±0.85	29.75^{b}±1.54	**

[a, b, c] Means within the same row with different superscripts are significantly different at P=0.05. Sig. =Significance NS = Not significant * (P≤0.05) ** (P≤0.01).

Table (7): Effect of feeding different levels of dried carrot waste (DCW) on economical traits of growing rabbits.

Items	Control	25%CW	50%CW	75%CW	Sig.
Total feed intake (kg/rabbit)	4.85^{a}±0.16	4.72^{a}±0.08	4.84^{a}±0.05	4.38^{b}±0.04	*
Live body weight	1.99^{ab}±0.08	2.01^{ab}±0.11	2.04^{a}±0.02	1.80^{b}±0.01	*
Total feed cost (LE)	7.27^{a}±0.25	6.58^{b}±0.11	5.67^{c}±0.07	4.12^{d}±0.04	**
Total return (LE)*	29.95^{ab}±1.27	30.25^{ab}±1.75	30.69^{a}±0.36	27.00^{b}±0.29	*
Net return (LE)**	10.67±1.02	11.66±1.65	13.01±0.32	10.88±0.28	NS
Economical efficiency (%)	145.7^{b}±9.7	176.2^{b}±22.7	229.3^{a}±5.3	264.0^{a}±7.2	**
Performance index	48.18^{ab}±3.15	51.06^{a}±5.18	51.40^{a}±0.94	39.93^{b}±1.60	*

[a, b] Means within the same row with different superscripts are significantly different, Sig. =Significance NS=Non Significant, * (P≤0.05), ** (P≤0.01).

* Based upon the price of 1 Kg live weight = 15.0 L.E. at time of experiment.

** Net return = Total return – [Total feed cost+ Fixed cost (12.0 L.E.)]

(1992), who reported that Hubbard broilers fed diets containing sun-dried carrot residue up to 12% had no significant differences in dressing, heart and liver weight percentages.

Blood components:

The results of blood constituents in Table (6) indicated that serum proteins and albumin levels were significantly increased while serum glucose, urea-N and GPT levels were decreased in general for growing rabbits receiving different levels of DCW compared with those fed control diets. On the other hand, there were no significant differences in serum total lipids, cholestrol and globulin levels between the different treatments. Rabbits fed 50% DCW diet recorded significant increase in A/G ratio compared with control group while no significant differences were noticed between the other levels of DCW and either control or 50% DCW groups. Rabbits receiving 75% DCW diet had the lower value of serum GOT than those fed the other treatment diets. The increase in Serum protein and albumin may be an indication of protein reserves in the body as reported by Allison (1955). Results obtained in this study were in partial agreement with the findings of Hillyer and Quesenberry (1994) who found that the normal values of some blood components in rabbits were 5.4 – 8.3 g/dl, 2.4 – 4.6 g/dl, 1.5 – 2.8 g/dl, 13 – 29 mg/dl, 10 – 80 mg/dl, 243 – 390 mg/dl, 48 – 80 U/l and 14 – 113 U/l for total protein, albumin, globulin, urea-N, cholesterol, total lipids, GPT and GOT, respectively.

Economical evaluation:

It is clear that using DCW in rabbit diets decreased the total cost of the consumed diets by 9.5, 22 and 43.3 % when compared with control diet cost. Using DCW at the levels of 50 or 75% DCW improved the percent of economical efficiency expressed as % of net return/feed cost and relative economical efficiency than those received either 25% DCW or control diets.

This improvement in economical evaluation (Table 7) for 50% DCW group may be due to the improvement in body weight and feed conversion ratio. The results of performance index indicated that there were no significant differences between the different DCW levels and control group while the levels of 25 and 50% gave better values compared with the other two treatment groups.

In conclusion, the results indicated that dried carrot waste could be used up to 50% in growing rabbit diets in place of the most conventional ingredients without any adverse effects on productive performance, nutrients digestibility, blood components and the economical efficiency.

REFERENCES

Allison, J.B (1955).Biological evaluation of protein. Physiology rev., 35: 664.

A. O. A. C. (1996).Official Methods of Analysis, Association of Official Analytical Chemists. 16th edition, Washington, USA.

Bao, B. and K.C. Chang (1994). Carrot pulp chemical composition, color and water-holding .capacity as affected by blanching. J. Food Sci., 59: 1159-1167.

Cheeke, P.R. (1987). Rabbit Feeding and Nutrition. Academic press, NewYork

Cheeke, P. R., N.M. Patton and G.S. Tempelton (1982). Rabbit production. 5th

Edition, Interstate Printers and Publishers Danville II., USA.

Duncan, D.B. (1955). Multiple range and multiple F test. Biometrics, 11:1-42.

Fekete, S and T. Gippert (1986). Digestibility and nutritive value of nineteen important feedstuffs for rabbits. J. Appl. Rabbit Res., 9 (3) : 103.108.

Goering, H. K. and P.T. Van Soest, (1970). Forage fiber analysis (apparatus, reagent, procedures and some applications). ARS, US. Dept. Agr. Handbook, Washington, DC. 20402.

Hillyer, E.V. and K.E. Quesenberry (1994). Ferrets, rabbits and rodents clinical medicine and surgery. Basic Approach to veterinary care rabbits, 165-166.

Manjunatha, S.S., B.L. Mohan Kumar and D.K. Das Gupta (2003). Development and Evaluation of carrot kheer mix. J. Food Sci. Technol., 40: 310-312

National Research Council, N.R.C. (1977). Nutrient requirements of rabbits. National Academy of Science, Washington, D.C.

North, M.O. (1981). Commercial chicken. Production Annual. 2nd Edition, AV., publishing company I.N.C., Westpost Connicticut, USA.

Sakhawat Ali Rehman, Z.U. Khan, and F.H. Shah (1992). Utilization of carrot residue in poultry feed. Pakistan Journal of Scientific and Industrial Research.. 35: 7/8, 302-303.

SAS, (1998). SAS. Procedure Guide. Version 6.12 Ed. "SAS Institute Inc. Cary, NC.USA.

Schweiggert, U.; T. Stoll; A. Schieber and R. Carle (2004). Carrot pomace - a source of carotenes and oligogalacturonic acids . IFT Annual Meeting, July 12-16, Las Vegas, NV.

Shrivastva, R.P. and Sanjeev Kumar (2005). Fruit and vegetable preservation principles and practices. International Book Distributing Co., Lukhnow, Utter Pradesh (India).

Sikder, A.C. Chowdhury, SD Rashid, MH Sarker, and S.C. Das (1998). Use of dried carrot meal (DCM) in laying hen diet for egg yolk pigmentation. Asian-Australasian Journal of Animal Sci., 11: 3, 239-244.

تأثيراستخدام مخلف تصنيع الجزر المجفف فى علائق الارانب النامية

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استخدم فى هذه الدراسة عدد ستون أرنب ركس مفطوم على عمر ستة اسابيع بمتوسط وزن مبدئى827.7±79 ، وذلك لدراسة تأثير استخدام مستويات مختلفة من مخلف تصنيع الجزر المجفف على أداء النمو، معاملات الهضم، مقاييس الدم، خصائص الذبيحة و اقتصاديات الانتاج. وزعت الارانب عشوائيا على اربع مجموعات تجريبية تتكون كل منها من خمسة عشر ارنبا فى خمس تكرارات بكل منهم ثلاث حيوانات. غذيت المجموعة الأولى على العليق الكنترول بدون اضافة مخلف الجزر المجفف، فى حين غذيت المجموعة الثانية، الثالثة والرابعة على علائق محتوية على 25، 50، و 75% مخلف الجزر المجفف، على الترتيب. أوضحت النتائج أن أستخدام مخلف الجزر المجفف بمستوى 50% أعطى زيادة غير معنوية فى وزن الجسم والوزن المكتسب اليومى وذلك بالمقارنة بالمجموعة الكنترول أوالمجموعة المغذاة على 25% مخلف الجزر المجفف عند عمر 10 و 14 أسبوع. فى حين أن المجموعة المغذاة على 75% مخلف الجزر المجفف سجلت إنخفاض معنوى فى وزن الجسم و الوزن المكتسب اليومى بالمقارنة بمثيلتها المغذاة على عليقة بها 50% مخلف الجزر المجفف. لم يتأثر كل من المستهلك اليومى من العلف و معامل التحويل الغذائى خلال الفترات التجريبية باستخدام مخلف الجزر المجفف حتى مستوى 50%. أدى استخدام مخلف الجزر المجفف بمعدل 50% الى تحسن معنوى فى معاملات هضم المادة الجافة، المادة العضوية، البروتين الخام و الألياف الخام و البروتين الخام المهضوم وذلك عند مقارنتها بالمجموعات التجريبية الأخرى. سجلت معاملات هضم المستخلص الايثيرى، المستخلص الخالى من النيتروجين و المركبات المهضومة الكلية أقل معدلاتها فى المجموعة المغذاة على 75% مخلف الجزر المجفف بالمقارنة بالمجموعات الأخرى. لم تظهر أى فروق معنوية فى قيم خصائص الذبيحة بين المجموعات المختلفة بما فيها مجموعة الكنترول. ارتفعت مستويات الألبيومين والبروتين فى بلازما الدم معنويا فى حين انخفضت مستويات البلازما من الجلوكوز، اليوريا ، GPT وذلك فى المعاملات المغذاة على مستويات مختلفة من مخلف الجزر المجفف عند مقارنتها بالكنترول. لم تظهر فروق معنوية فى قيم اللبيدات الكلية ، الكوليسترول و الجلوبيولين فى بلازما الدم بين المجموعات المختلفة. سجلت المجموعة المغذاة على 75% مخلف الجزر المجفف معدل أقل من GOT فى سيرم الدم بالمقارنة بالمجموعات التجريبية الأخرى. أدى استخدام مخلف الجزر المجفف فى علائق الأرانب الى تقليل كلفة العلائق بمعدل 9.5، 22.0 و 43.3% عند مقارنتها بتكلفة عليقة الكنترول، كما أدى استخدام مخلف الجزر المجفف بمستوى 50% الى تحسين الكفاءة الاقتصادية و الكفاءة الاقتصادية النسبية عند مقارنتها بالمجموعة المغذاة على 25% مخلف الجزر المجفف أو بمجموعة الكنترول. نستخلص من النتائج السابقة أنه يمكن استخدام مخلف الجزر المجفف حتى معدل 50% بدلا من معظم مواد العلف التقليدية فى علائق الأرانب النامية بدون اى تأثرات عكسية على الأداء الانتاجى، معاملات الهضم و مكونات الدم.