

EFFECT OF INCORPORATING PROCESSING DRIED WASTE OF GREEN BEAN (*PHASEOLUS VULGARIS*) IN GROWING RABBITS DIETS

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SUMMARY

This study was conducted to investigate the effect of incorporating processing waste of dried green bean (*Phaseolus vulgaris*) (GBPW) in diets of growing NZW rabbits on nutrients digestibility, live body weight, body weight gain, carcass traits and some blood parameters. Fifty –six New Zealand White (NZW) rabbits were chosen after weaned at 6 weeks of age and randomly divided into four groups (14 rabbits/group) according to their initial live body weight (740 ± 20 g). The experimental period extended from 6 to 14 weeks of age. Four pelleted experimental diets were formulated to be approximately isocaloric, isonitrogenous and isofibrous. Dried green bean processing waste (GBPW) was incorporated at levels of 0, 10, 20 and 30% for rabbit groups, G0 (as control), G1, G2 and G3, respectively. At the end of the feeding experimental (14 weeks of age), digestibility trials were conducted to determine the nutrients digestibility and feeding values of the experimental diets. Three rabbits were slaughtered from each group to test the carcass traits and some blood plasma parameters. Results revealed that the chemical composition of GBPW recorded 87.78, 80.43, 22.37, 29.00, 4.37, 19.57 and 24.69%, respectively for DM, OM, CP, CF, EE, Ash and NFE. Significant differences ($P < 0.05$) between control diet (G0) and tested diet (G3) in digestion coefficients of OM, CP and CF as well as the feeding values (DCP and DE) which had highest values. Inversely the tested diets did not differ significantly with control one in digestion coefficients of DM, EE and NFE, as well as TDN value. No significant differences among dietary groups in live body weight at 6 and 10 weeks with the highest values 779.29 and 1477.5g, respectively in G3. On the other hand, the live body weight at 14 weeks was significantly affected ($P < 0.05$) by the level of incorporating GBPW in diets with the highest value (2100g) in G3 compared with control group G0 and G1. The same trend was found for total body gain (6-14 weeks) and daily gain, where G3 recorded the highest values. Insignificant differences among the experimental diets respecting feed conversion, however, G1 had the better one in the period 6-14 weeks of age. The green bean processing wastes (GBPW) levels had no significant effect on most carcass traits, G1 had the higher of liver weight and edible giblet percentage. In respect to chemical composition of rabbit's meat on DM basis, the experimental diets did not significantly effect on DM, CP and ash, while, EE percentage was affected especially for G3 as it had the highest value. On the other hand, chemical composition of fresh meat showed that higher CP% was found for G0, the lower was for G3, while, the later had the higher EE content and G1 was lower one. No significant differences for DM and ash contents were found among the groups. No significant differences in blood plasma total protein and globulin were showed among the experimental diets. Plasma albumin, ALT, AST, urea and total cholesterol were significantly affected ($P < 0.05$) by experimental diets. Less albumin, ALT and AST were shown by G0, while less urea and cholesterol was recorded for G3. On the other hand, higher urea and cholesterol was shown by G0. Increase the rate of incorporating the GBPW from 0 to 30% in experimental diets lead to improvement in economic efficiency and relative economic efficiency. In conclusion dried green bean processing wastes could be used in feeding of growing rabbits up to 30% with no adverse effect on productive performance, carcass traits, physiological function and economical efficiency.

Keywords: *NZW rabbits, green bean processing wastes, digestibility, productive performance, carcass traits, blood parameters and economical efficiency.*

INTRODUCTION

As it is commonly known, feeding is the main factor that affect animal in general and rabbits production especially. However, feeding cost for rabbits is considered to be the most expensive item, since it represents about 60-65% of total production cost. Crops residues, which annually producing by huge amounts are considerably a potential supply of manipulated feeds for feeding animals in Egypt and the most developing countries (Mohamed *et al.*, 2012). The annual production of vegetables and fruits by-products (filed and food industrial) in Egypt were estimated to be about 32 million tons (Agricultural Economics-Ministry, 2014) more

than two third of this amount is left annually without use. In Egypt, food processing is the second largest industry (El-Araby *et al.*, 2005), which considered a good source for essential amino acids, vitamins and minerals. Also, it contains good energy and protein, including both soluble carbohydrates and readily digestible NDF fractions, but its high moisture content may limit its storage (Mohamed *et al.*, 2012). The green bean *Phaseolus vulgaris* is considered one of the most important vegetable crops grown in Egypt, and occupies a great part of local consumption and export, the cultivated area of green bean in Egypt is 2.4% of the total world cultivated area, producing about 3.5% of the total world production of bean (El-Noemani *et al.*, 2010). Green beans and other beans, such as kidney beans, navy beans and black beans are all known scientifically as *Phaseolus vulgaris* the common bean, which has been used throughout history to feed both humans and animals. Though raw beans have a relatively low concentration of digestible protein (Koehler *et al.*, 1986), they are an important crop in areas with limited access to animal proteins or technological advances for further food processing. The seeds of several species of bean and particularly those from the genus *Phaseolus* have long been known to be rich source of proteins, minerals, vitamins, and energy in diets for human and animals (Arija *et al.*, 2006).

Incorporation of cheap unconventional feedstuffs in rabbit diets may participate partially 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 material 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 (El-Medany *et al.*, 2008).

The objective of this study was to determine the effect of incorporating processing waste of dried green bean (*Phaseolus vulgaris*) in New Zealand white (NZW) growing rabbits diets, on productive performances, nutrient digestibility, feeding value and economic efficiency.

MATERIALS AND METHODS

The present study was conducted at Sakha Experimental Research Station, Animal Production Research Institute, Agricultural Research Center, Egypt, in order to study the effects of incorporating dried green bean (*Phaseolus vulgaris*) processing wastes (GBPW) in New Zealand white growing rabbits diets. Fresh green bean processing waste was obtained from Montana Company at El-Qalyubia Governorate during November and December months. These vegetable crop processing wastes were in wet form with moisture content about 90%. So, it was dried by sun-drying for 15 days until it reached 10% moisture, finely it ground and thoroughly homogenized before mixing with the other ingredients to form the experimental diets.

Feeding and management:

Fifty-six New Zealand White (NZW) rabbits were chosen after weaned at 6 week of age and divided into four groups (14 rabbits/ groups) according the their initial live body weight (740 ± 20 g). The experimental period extended from 6 to 14 weeks of age. Four pelleted experimental diets were formulated to be approximately isocaloric, isonitrogenous and isofibrous. Dried green bean processing waste (GBPW) was incorporated at levels of 0, 10, 20 and 30% in four groups, Go (as control), G1, G2 and G3, respectively. All diets were pelleted according to Agriculture Ministry Decree, (1996) for growing rabbits. Rabbits were housed in galvanized wire batteries in a well-ventilated building (natural through the window) and offered the experimental diets ad libitum. Fresh water was available at all times from automatic drinkers with nipples for each cage. Urine and faces dropped from cages on the floor were cleaned every day in the morning. All rabbits were kept under the same managerial, hygienic and environmental conditions and vaccinated against common diseases. All rabbits were individually weighed at the beginning of the experiment, then weekly before offering the morning meal until marketing age (14 weeks). Feed intake was weekly recorded during the experimental period. Live body weight, weight gain, feed intake, feed conversion (g feed/g gain) and economic efficiency were estimated. Ingredients and calculated chemical composition of the experimental diets are presented in Table (1).

Table (1): Ingredients and calculated chemical composition of the experimental diets (as fed).

Item	Experimental diet			
	G0	G1	G2	G3
Ingredients (%)				
Clover hay (12% CP)	30	23	16	9
Green bean processing waste (GBPW)	-	10	20	30
Yellow corn	20.50	21.15	21.55	22.00
Soybean meal (44%CP)	17.90	16.00	13.50	11.30
Wheat bran	24.75	23.00	22.10	20.85
Molasses	4.00	4.00	4.00	4.00
DL- Methionine	0.10	0.10	0.10	0.10
Vitamins and minerals mixture ¹	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
Limostone	1.05	1.05	1.05	1.05
Di calcium phosphate	0.50	0.50	0.50	0.50
Anti- Fungi	0.10	0.10	0.10	0.10
Anti-Coccidia	0.10	0.10	0.10	0.10
Total	100	100	100	100
Calculated analysis ²				
Dry matter (DM), %	86.87	86.72	86.59	86.45
Organic matter (OM), %	80.90	79.87	78.82	77.82
Crude protein (CP), %	17.00	17.08	17.04	17.00
Ether extract (EE), %	2.67	2.83	3.01	3.18
Nitrogen free extract (NFE), %	47.73	46.33	44.92	43.68
Ash, %	5.97	6.85	7.77	8.63
Digestible energy (DE) ³ , kcal/kg	2508	2511	2505	2508
Crude fiber (CF), %	13.50	13.63	13.85	13.96
NDF%	37.79	37.88	38.02	38.10
ADF%	21.75	21.86	22.07	22.17
Hemicellulose %	16.05	16.02	15.95	15.93
Calcium, %	1.05	1.15	1.25	1.34
Total phosphorus, %	0.566	0.539	0.520	0.492
Methionine	0.37	0.36	0.34	0.33
Lysine	0.81	0.76	0.69	0.63
DE:CP	147.53	147.01	147.01	147.53

1-Supplied per Kg. of diet: 12000 IU Vit. A; 2200 IU D3; 10mg Vit. E; 2.0 mg Vit.K3; 1.0 mg Vit. B1; 4.0 mg Vit. B2; 1.5 mg Vit. B6; 0.0010mg Vit. B12; 6.7 mg Vit. Pantothenic acid;6.67 mg Vit. B5; 1.07mg Biotin; 1.67 mg Folic acid; 400 mg Choline chloride; 22.3 mg Zn;10 mg Mn; 25 mg Fe; 1.67 mg Cu; 0.25mg I; 0.033 mg Se and 133.4 mg Mg.l.

2-According to MOA (2001).

3-Calculated according to Cheeke (1987): $DE (Kcal/g) = 4.36 - 0.0491 (\%NDF)$, $\%NDF = 28.924 + 0.657 (\%CF)$, $\%ADF = 9.432 + 0.912 (\%CF)$, $ADF = cellulose + lignin and Hemicellulose = \%NDF - \%ADF$.

G0= 0% GBPW, G1= 10% GBPW, G2= 20% GBPW and G3= 30% GBPW.

Digestibility trial:

At the end of the experimental feeding (14 week of age), four digestibility trials were conducted to determined the nutrients digestibility and feeding values of the experimental diets. A total number of 12 rabbits were taken randomly (3 rabbits / group), they were housed individually in metabolic cage to facilitate the collection of all droppings. Feed intake was daily recorded and quantitative collection of faces was started 24 hour after offering the daily feed. Faces of each rabbit were collected every day in the morning for a period of 5 days and sprayed with 2% boric acid for trapping any ammonia released then oven dried at 60°C till constant weight, finely ground and stored for chemical analysis.. Representative samples of diets, GBPW and feces were analyzed according to A.O.A.C. (1999). Digestion coefficients of nutrients and feeding values were calculated according to Abou-Raya (1967).

Carcass traits:

At the end of the feeding trials (14 week of age), three rabbits representing each dietary treatment were randomly taken to evaluate the carcass traits. Rabbits were fasted for approximately 12 hour and individually weighed to record the pre-slaughter weight. After complete bleeding and skinning, the empty carcass with head, liver, kidneys and heart were weighed separately according to Cheeke (1987). Individual blood samples (from the same slaughtered rabbits) were collected in dry clean centrifuge tubes containing few drops of heparin solution and centrifuged at 3000 r.p.m. for 20 minutes to separate blood plasma and then stored in deep freezer at approximately -20°C until the time of analysis to estimate blood parameters. Various chemical analyses were conducted using commercial kits and measuring the optical

density by spectrophotometer, following the same steps as described by manufactures. Plasma total proteins assay was determined according to Gornal *et al.* (1949). Albumin plasma was determined according to Doumas *et al.* (1971), urea was determined according to Fawcett and Scott (1960), total cholesterol was determined according to Richmond (1973). AST was determined according to Young (1990) and ALT activities were determined according to Reitman and Frankel (1957). The plasma globulin was calculated by the differences.

Economic efficiency:

Economic efficiency was calculated as the ratio between income price of weight gain and the cost of feed consumed over 6-14 weeks of age.

Statistical analysis:

Data were analyzed for all variable using the general linear model procedure to establish the differences between means using SAS software version 9.1 (SAS, 2004). The model used was:

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

Where: Y_{ij} = the observation of ij , μ = the overall mean, T_i = the effect of treatment I and e_{ij} = the experimental random error.

Data of percentages were subjected to arc-sin transformation to approximate normal distribution before being analyzed. Variables having a significant F-test were compared using Duncan's multiple rang test (Duncan, 1955). All statements of statistical significance were based on probability ($P < 0.05$).

RESULTS AND DISCUSSION

Chemical composition of feedstuffs and diets:

Chemical composition of dried green bean processing waste (GBPW) and the experimental diets was showed in Table (2). The results of chemical analysis showed that GBPW had a good amount of nutrients (87.78, 80.43, 22.37, 29.00, 4.37, 19.57 and 24.69%, respectively for DM, OM, CP, CF, EE, ash and NFE). Costa *et al.* (2006) reported that the crude protein content of the green bean processing waste (22%) was found to be higher than some other common legumes such as *Pisum sativum* (21.9%); *Phaseolus vulgaris* (20.9%); *Cicer arietinum* (18.5%) and *Lens culinaris* (20.6%). According to Catootjie, (2009) GBPW represents a good source of protein (20.0%).

Results of chemical composition of experimental diets (Table 2) showed slightly differences among control group and tested groups (G0 up to G3) in percentages of (DM, CP and NFE). Diet G1 recorded the highest values of DM, CP and NFE (90.73, 19.70 and 53.37%, respectively). On the other hand, the lowest percentages of DM, CP and NFE were found in G3 (89.64, 19.36 and 51.19%, respectively).

Table (2): Chemical composition of ingredients and the experimental diets (% on DM basis).

Item	DM	OM	CP	CF	EE	NFE	Ash
GBPW	87.78	80.43	22.37	29.00	4.37	24.69	19.57
Chemical composition of experimental diet							
G0	90.57	90.66	19.50	13.37	4.81	52.98	9.34
G1	90.73	89.07	19.70	11.40	4.60	53.37	10.93
G2	89.64	87.96	19.50	10.92	5.36	52.18	12.04
G3	89.25	88.91	19.36	12.30	6.06	51.19	11.09

GBPW=Green bean processing west, G0 (control diet) = Diet contain 0% GBPW, G1= Diet contain 10% GBPW, G2= Diet contain 20% GBPW and G3= diet contain 30% GBPW.

Results of cell wall contents of green bean processing waste (GBPW) are presented in Table (3). The GBPW cell wall contents were recorded to be 47.98% (NDF), and 35.88%, (ADF). The cellulose content of GBPW was 23.43% , hemicellulose (12.10%) and its lignin content was 12.45%. The obtained results disagreement with those reported by Abdel-Moneim, (2013), who found that, NDF was 34.71% , and ADF was 10.75%,, cellulose content was 6.25g%, hemicellulose 23.96% and lignin content was 4.5%.

Table (3): Cell wall constituents of green bean processing waste (GBPW) (% as fed)

Item	NDF	ADF	ADL	Hemicellulose	Cellulose	DE
GBPW	47.98	35.88	12.45	12.10	23.43	2000

Calculated according to Cheeke (1987): $DE (Kcal/kg) = 4.36 - 0.0491 (\%NDF)$, $\%NDF = 28.924 + 0.657 (\%CF)$, $\%ADF = 9.432 + 0.912 (\%CF)$, $ADF = \text{cellulose} + \text{lignin and Hemicellulose} = \%NDF - \%ADF$.

Digestion coefficients and feeding values of the experimental diets:

Nutrients digestibility and feeding values of experimental diets are shown in Table (4). Integrated GBPW with experimental diets resulted in improving the digestibility coefficients of OM, CP, CF and NFE with G1, G2 and G3 diets as compared to those of control diet (G0), but the differences among them were insignificant. On the other hand, G3 significantly differed ($P < 0.05$) with control group (G0) for digestion coefficients of OM, CP and CF. The highest values of all digestibility nutrients were associated with 30% GBPW (G3) expect for EE and NFE. The lowest values were found to be for control group (G0). Values of TDN for the experimental groups were insignificant differ although G3 had the highest TDN value compared to other groups. The DCP% and DE affected significantly ($P < 0.05$) by integrated all levels of GBPW with experimental diets as they recorded the highest values (14.02% and 3048 kcal/kg) for G3. The integration of GBPW with the experimental diets by 30% (G3) resulted to significantly increased all nutrients digestibility and feeding values that might be attributed to availability of protein. These results are agreements with those obtained by Hassan *et al.* (2012) who reported that group fed 50% pea vines (replacement of clover hay) tended higher digestibility of all nutrients compared with groups contained 0, 25, 75 and 100% pea vines. Also, they found higher DCP, TDN and DE with ration contained 50% pea vines than the other ones.

The utilization of dietary energy depends not only on the profile of nutrients made available from a particular feed but also from nutrients made available from other feeds those involved in a ration. So, this kind of interaction between the different ingredients of the ruminants rations nutritionally being known as associative effects of feeds in ruminants (Huhtanen, 1991). The present results are in agreement with those obtained by Galal *et al.* (2016) who replaced 0, 30, 70 and 100% of clover hay by strawberry vines hay with lactating goats, and Fayed (2014) who replaced 0, 25, 50, 75 and 100%, of clover hay by the mixture of tomato and apple pomace by-product in feeding lambs. They were found that the highest values of digestibility of nutrients were occurred with the replacement rate at 30-50% and started to decrease at the higher levels up to 100%.

Table (4): Digestion coefficients and feeding values of the experimental diets.

Item	Experimental diet				±SE
	G0	G1	G2	G3	
	Digestibility (%)				
DM	65.08	66.12	67.56	69.22	±1.54
OM	65.38 ^b	67.48 ^{ab}	69.35 ^{ab}	71.29 ^a	±1.67
CP	62.86 ^b	66.88 ^{ab}	68.42 ^{ab}	72.43 ^a	±2.05
CF	27.40 ^b	33.15 ^b	36.21 ^{ab}	43.44 ^a	±2.89
EE	80.96	72.04	69.63	71.66	±3.50
NFE	74.32	74.64	76.67	77.51	±1.68
	Feeding values (%)				
TDN	66.45	65.68	66.41	68.48	±1.65
DCP	12.26 ^b	13.18 ^{ab}	13.30 ^{ab}	14.02 ^a	±0.40
DE kcal/kg	2943.8 ^b	2909.4 ^{ab}	2941.9 ^{ab}	3048.8 ^a	73.06

a and b means in the same row for each parameters with different superscripts are significantly different (P < 0.05). SE=Standard error.

Productive performance:

Concerning daily feed intake there were slight differences among the experimental diets with highest value (98.45g) in G3 at the whole experimental period.

Data of body weight, total weight gain, daily weight gain, daily feed intake and feed conversion are presented in Table (5). Results showed that no significant differences among tested groups in their initial body weight and the weight at 10 weeks with the highest values (779.29 and 1477.5 g, respectively) in G3 which had 30% GBPW. On the other hand, the body weight at the end of the experimental period (14 week) was significantly affected ($P<0.05$) by the incorporating level of GBPW in diets with the highest value (2100 g) in G3 compared with control group G0 and G1. The same trend was found for total body weight gain and daily gain where G3 recorded the highest values of total gain (698.21g, 622.5g and 1320.71g) for 6-10 weeks, 10-14 weeks and 6-14 weeks, respectively. Also, G3 had the highest values of daily weight gain (24.93g, 22.23g and 23.58g) for 6-10 weeks, 10-14 weeks and 6-14 weeks, respectively. Improving feed intake and the digestion coefficients of most nutrients and feeding values with the tested groups G1 to G3 was reflected on increase in body weight, total body weight gain and daily gain by rabbits fed such diets.

Data of Table (5) indicated insignificant differences among the experimental groups respecting feed conversion. The best values were 3.70, 5.66 and 4.62 for 6-10 weeks, 10-14 weeks and 6-14 weeks, respectively in control group (G0) compared with other tested groups. These results are in agreement with those reported by Abdel-Magid (2005) and Hamed and Bader (2013), they observed that rabbits fed diets containing pea straw instead of clover hay had higher feed consumption and good feed conversion. However, better feed conversion was obtained with incorporating 10% GBPW in the diet for 10-14 and 6-14 weeks, while incorporating 20% of GBPW was better for the period 6-10 weeks than other groups. In all cases, control group was the best feed conversion but with insignificant differences.

Table (5): Effect of different experimental diets on productive performance for growing NZW rabbits through different ages.

Item	Experimental group				±SE
	G0	G1	G2	G3	
Live body weight (g)					
Initial (6weeks)	745.71	723.57	720.71	779.29	±45.25
10 Weeks	1328.21	1358.21	1398.93	1477.50	±64.21
14 Weeks	1883.57 ^b	1912.50 ^b	1958.21 ^{ab}	2100.00 ^a	±53.02
Total weight gain (g)					
6-10 weeks	582.50	634.64	678.21	698.21	±43.66
10-14 weeks	555.63	554.29	559.29	622.50	±36.05
6-14 weeks	1137.86 ^b	1188.93 ^{ab}	1237.50 ^{ab}	1320.71 ^a	±50.73
Daily weight gain (g)					
6-10 weeks	20.80	22.66	24.22	24.93	±1.56
10-14 weeks	19.84	19.79	19.97	22.23	±1.29
6-14 weeks	20.32 ^b	21.23 ^{ab}	22.10 ^{ab}	23.58 ^a	±0.91
Daily feed intake (g)					
6-10 weeks	76.93	76.35	79.16	87.13	
10-14 weeks	112.26	96.71	107.56	109.64	
6-14 weeks	93.82	86.12	92.18	98.45	
Feed conversion (g feed/g gain)					
6-10 weeks	3.70	3.37	3.27	3.49	±0.30
10-14 weeks	5.66	4.88	5.38	4.93	±0.52
6-14 weeks	4.62	4.06	4.17	4.17	±0.20

a and b, means in the same row for each parameters with different superscripts are significantly different $P<0.05$.

Carcass traits:

Data of Table (6) indicated insignificant differences among the experimental diets for pre-slaughter weight, fur weight and head weight although G0 had the more weights. Diet G1 showed higher ($P<0.05$) liver weight and edible giblets values (66.43g and 4.67%) compared with G2, but with insignificant different with other groups. On the other hand, the carcass weight (without head), dressing percentage, total edible percentage and non edible percentage were not significantly affected among the experimental diets. It could be concluded that green bean processing wastes (GBPW) levels had no significant effect on

most carcass traits regardless the liver weight, heart percentage and edible giblet percentage. These results are in harmony with those reported by El-Adawy and Borhami (2001) ; El-Gendy *et al.* (2002) ; Abdel-Magid (2005) ; El-Medany *et al.* (2008) ; Hassan (2009) and Omar *et al.* (2011), They noted that feeding growing rabbits diets whereas clover hay was replaced by pea veins , chick pea or kidney beans, beans straw , peanut hay, green bean and pea by-product, dried carrot processing waste or strawberry by – product had no significant effect on most carcass traits.

Table (6): Effect of feeding different experimental diets on carcass traits for growing NZW rabbits.

Item	Experimental diet				±SE
	G0	G1	G2	G3	
Pre-slaughter weight (g)	1838.3	1835.00	1798.33	1833.33	±43.92
Fur weight (g)	340.00	325.00	325.00	316.67	±15.02
Head weight (g)	120.00	115.00	106.67	116.67	±3.99
Liver weight (g)	60.27 ^{ab}	66.43 ^a	53.40 ^b	63.90 ^{ab}	±3.57
Liver %	3.28	3.62	2.96	3.49	±0.20
Kidney weight (g)	12.30	12.47	11.47	11.83	±0.80
Kidney %	0.67	0.68	0.64	0.65	±0.05
Heart weight (g)	8.37	6.70	5.10	7.03	±0.97
Heart %	0.46 ^a	0.36 ^{ab}	0.28 ^b	0.38 ^{ab}	±0.05
Carcass weight (without head) (g)	846.67	861.67	856.67	835.00	±38.51
Dressing %	52.54	53.18	53.59	51.89	±1.32
Edible giblets %	4.40 ^{ab}	4.67 ^a	3.89 ^b	4.52 ^a	±0.18
Total edible %	56.95	57.85	57.48	56.42	±1.32
Non edible %	43.05	42.15	42.52	43.58	±1.32

a and, b means in the same row for each parameters with different superscripts are significantly different P<0.05). SE=Standard error.

*Total edible parts wt. = Empty carcass wt.(with head)+ edible giblets wt. ; Edible giblets wt. = Liver wt. + kidney wt. + heart wt. ; Total edible parts % = Total edible parts wt./slaughter wt.*100*

Chemical composition of rabbit's meat:

Effects of dried green bean processing waste levels on chemical composition of rabbit's meat on DM basis is shown in Table (7). The experimental diets were not significantly affected on DM, CP and ash of rabbits meat, the control group had more percentages (96.66, 79.59 and 5.47 %, respectively) than other groups. While, EE percentage was significantly affected by incorporating green bean processing at the rate of 20 and 30% the less values obtained for G0 and G1. In this respect, Khashaba *et al.* (2002) and Abdel-Magid *et al.* (2005) found no significant differences in chemical composition of rabbit's meat among experimental diets contained 0, 33 and 66% pea by-product.

Blood parameters:

Means of some blood plasma parameters are presented in Table (8). The results non significant differences (P<0.05) in blood plasma total protein and globulin among experimental groups with more values (6.70 and 3.21g/dl), respectively for G1 which had 10% GBPW. These results are in agreement with those reported by El-Bordeny *et al.* (2011) who found that replacing clover hay by palm tree leaves caused no significant effects in plasma total protein and globulin concentrations as compared to the control group. Also, similar results were found by Galal *et al.* (2014) in V line growing rabbits with replacing clover hay by strawberry vines. On the other hand, blood plasma albumin, ALT, AST, urea and total cholesterol were significantly affected (P<0.05) by experimental diets. The lowest values (3.27g/dl, 24.81U/L and 14.67 U/L) for albumin, ALT and AST, respectively in control groups (G0), while, control group had the highest values of (47.45mg/dl and 155.28mg/dl) for urea and total cholesterol, respectively. Higher (P<0.05) albumin value was recorded by G2 and G3 compared with G1 and G0, whereas the later was recorded the lowest value (3.27g/dl). Value of ALT was high (P<0.05) for G3 followed by G1 and G2, while, the lowest (P<0.05) value was found for the control group. G2 had the higher (P<0.05) AST value compared with G0, but it was not significantly differ to the rest of groups (G1 and G3). On the other hand, the control group had the higher (P<0.05) urea and total cholesterol values compared with other experimental groups. Lower urea value recorded for G2 and G3, while G1 had intermediate value. In the meantime, G3 had the lower (P<0.05) total cholesterol followed by G2, while, G1 had intermediate value.

Table (7): Effect of feeding different experimental diets on chemical composition of meat for growing NZW rabbits.

Item	Experimental diet				±SE
	G0	G1	G2	G3	
Chemical composition % on DM basis:					
DM	96.66	96.24	96.93	95.85	±0.61
CP	79.59	75.90	78.05	73.90	±0.58
EE	12.06 ^b	11.40 ^b	17.24 ^a	18.23 ^a	±1.14
Ash	5.47	3.97	5.32	5.39	±0.58
Chemical composition % on fresh meat:					
Total moisture	76.48	78.26	78.00	78.42	±1.25
DM	23.52	21.74	22.00	21.58	±1.25
CP	18.72 ^a	16.48 ^{ab}	17.05 ^{ab}	15.88 ^b	±0.80
EE	2.86 ^{ab}	2.47 ^b	3.81 ^{ab}	3.94 ^a	±0.40
Ash	1.29	0.86	1.17	1.18	±0.16

a and, b means in the same row for each parameters with different superscripts are significantly different P<0.05). SE=Standard error.

Table (8): Some blood plasma parameters as affected by feeding experimental diets.

Item	Experimental diet				±SE
	G0	G1	G2	G3	
Total protein (g/dl)	6.44	6.70	6.68	6.53	±0.13
Albumin (g/dl)	3.27 ^c	3.49 ^b	3.62 ^a	3.65 ^a	±0.04
Globulin (g/dl)	3.17	3.21	3.06	2.88	±0.12
ALT (U/L)	24.81 ^c	26.86 ^b	28.36 ^b	31.27 ^a	±0.62
AST (U/L)	14.67 ^b	15.22 ^{ab}	16.13 ^a	15.46 ^{ab}	±0.38
Urea (mg/dl)	47.45 ^a	45.03 ^b	43.08 ^c	41.64 ^c	±0.48
Total cholesterol (mg/dl)	155.28 ^a	151.98 ^b	149.45 ^c	146.92 ^d	±0.74

a and, b means in the same row for each parameters with different superscripts are significantly different P<0.05). SE=Standard error.

Economical evaluation:

The economical efficiency of feeding the experimental diets are presented in Table (9). The profitability of using green bean processing waste in rabbits diets depend on the price of tested diets and

Table (9): Effect of feeding different experimental diets on economic efficiency for growing NZW rabbits.

Item	Experimental diets			
	G0	G1	G2	G3
Price/kg diet (L.E)	4.29	4.04	3.774	3.513
Total feed intake/rabbit (g)	5253.9	4822.7	5162.1	5513.2
Total feed cost / rabbit (L.E)	22.48	19.48	19.48	19.38
Total weight gain/ rabbit (g)	1137.86	1188.93	1237.50	1320.71
Feed cost/ kg gain (L.E)	19.76	16.38	15.74	14.67
Total revenue/ rabbit (L.E)	39.83	41.61	43.31	46.22
Net revenue/ rabbit (L.E)	17.35	22.13	23.83	26.84
Economic efficiency	0.77	1.14	1.22	1.38
Relative economic efficiency(%)	100	148	158	179

Based on prices of the Egyptian market during the experimental period (2017).

The price of one ton of clover hay(12% CP), green bean processing west (GBPW), yellow corn, soybean meal (44% CP), wheat bran, molasses, methionine, Vitamins & minerals mix. , salt, lime stone, Di-Calcium phosphate, Anti-Fungi and anti- Coccidia were 2500, 1000, 4500, 6500, 4000, 2200, 60000, 11000, 700, 700, 2000, 120000 and 120000 respectively. Net revenue (L.E)= (Total revenue/rabbit (L.E))-(Total feed cost/rabbit (L.E)). Economic efficiency = (Net revenue /rabbit(L.E))/(Total feed cost/ rabbit (L.E)).Feed cost /kg gain = Total feed cost (L.E)/ Total weight gain / rabbit (kg).

growth performance of rabbits fed these diets. Price of one kg fed (LE) was 4.04, 3.774 and 3.513 for G1, G2 and G3, respectively compared with control group G0 (4.29 L.E). Increase the rate of incorporating the green bean processing wastes from 0 to 30% in experimental diets lead to an increase in the total revenue, net revenue, economic efficiency and relative economic efficiency. However, the results were affected by the low price of GBPW and the improvement of growth rate for diets containing GBPW compared with control group. Relative economic efficiency values were 148, 158 and 179% for groups G1, G2 and G3, respectively. These results are in agreement with those obtained by Omar *et al.* (2011), Hamed and Badr (2013) and Galal *et al.* (2014), who observed that inclusion strawberry by products or pea straw to be partially or completely replacement of berseem hay contributed in lowering the feeding cost and hence increasing the economic efficiency.

CONCLUSION

According to the circumstances of this study, it could be concluded that incorporating dried green bean processing waste (GBPW) up to 30% in growing NZW rabbits diets could realized improvement in all digestion coefficients and feeding values, productive performance and improved the economic efficiency without adverse effect on health.

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تأثير إدخال مخلف التصنيع الغذائي الجاف للفاصوليا الخضراء في علائق الأرانب النامية

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أجريت هذه الدراسة في محطة بحوث الإنتاج الحيواني بسخا (كفر الشيخ) لمعرفة تأثير إدخال مخلف التصنيع الغذائي للفاصوليا الخضراء الجافة في علائق الأرانب النيوزيلندي الأبيض علي معاملات هضم العناصر الغذائية ووزن الجسم الحي ومعدل الزيادة اليومية والكلية في وزن الجسم وصفات الذبيحة وبعض قياسات الدم. تم إستخدام عدد 56 أرنب نيوزيلندي أبيض في عمر 6 أسابيع وقسمت عشوائيا إلي أربعة مجاميع (14 أرنب / مجموعة) طبقا لوزن الجسم (740 ± 20 جرام). وأستمرت التجربة من عمر 6 إلي 14 أسبوع ، تم تكوين أربعة علائق متزنة تقريبا من حيث محتواها من الطاقة والنترجين والألياف. حيث تم إدخال مخلف التصنيع الغذائي للفاصوليا الخضراء بمستويات صفر ، 10 ، 20 ، 30% في المجاميع التجريبية (كمجموعة مقارنة) ، ع1 ، ع2 ، ع3 علي التوالي ، في نهاية التجربة (عند عمر 14 أسبوع) تم إجراء تجربة هضم لتقدير معاملات هضم العناصر الغذائية والقيمة الغذائية للعلائق المستخدمة. كذلك تم ذبح ثلاث أرانب من كل مجموعة لقياس صفات الذبيحة وبعض قياسات الدم. وقد أوضحت نتائج التحليل الكيماوي لمخلف الفاصوليا الخضراء أن محتواه من المادة الجافة (87.78%) ، المادة العضوية (80.43%) ، البروتين الخام (22.37%) ، الألياف الخام (29%) ، مستخلص الأثير (4.37%) ، الرماد (19.57%) ، المستخلص الخالي من النيتروجين (24.69%). وجدت فروق معنوية (مستوي معنوية 0.05) بين مجموعة المقارنة (ع0) و (ع3) في معاملات هضم كلا من المادة العضوية ، البروتين الخام والألياف الخام وكذلك البروتين المهضوم والطاقة المهضومة حيث كانت أعلى القيم في ع3. علي العكس من ذلك لم توجد فروق معنوية بين المجاميع التغذوية ومجموعة المقارنة فيما يخص معاملات هضم كلا من المادة الجافة ، مستخلص الأثير ، المستخلص الخالي من النيتروجين والمركبات المهضومة الكلية. لم تؤثر مجاميع التغذية معنويا علي وزن الجسم عند 6 و 10 أسابيع وسجلت أعلى القيم (779.29 ، 1477.5 جرام) علي التوالي مع المجموعة ع3. بينما أثرت مجاميع التغذية معنويا (0.05) علي وزن الجسم عند عمر 14 أسبوع حيث تفوقت ع3 (2100 جرام) علي كلا من ع0 و ع1. نفس الاتجاه السابق وجد لصفة الزيادة الكلية في وزن الجسم حيث تفوقت المجموعة ع3 علي باقي المجموعات مع وجود إختلافات معنوية بينها وبين مجموعة المقارنة ع0 خلال الفترة الكلية للتجربة 6-14 أسبوع. كذلك أوضحت النتائج عدم وجود فروق معنوية بين المجاميع التجريبية في معدل تحويل الغذاء وسجلت عليقة المقارنة أعلى القيم خلال الفترات المختلفة. لم تسجل مجاميع التغذية أي فروق معنوية بالنسبة لمعظم صفات الذبيحة ما عدا وزن الكبد وونسبة وزن القلب ونسبة الأجزاء المأكولة. كذلك لم تؤثر معنويا علي التركيب الكيماوي للحم الأرانب وسجلت عليقة المقارنة أعلى القيم لكلا من نسبة المادة الجافة والبروتين بينما نسسة مستخلص الأثير سجلت أعلى القيم مع عليقة ع3 مع وجود فروق معنوية بينها وبين ع0 لم تسجل فروق معنوية بين المجاميع التجريبية بالنسبة البروتين الكلي الجلوبيولين في بلازما الدم بينما تأثر محتوى البلازما من الألبومين وإنزيمات الكبد واليورينا والكوليسترول الكلي معنويا بالعلائق التجريبية.

وتلخص النتائج إلي أنه يمكن الاستفادة من مخلفات التصنيع الغذائي للفاصوليا الخضراء في تغذية الأرانب حتي مستوي 30% مع عدم وجود أي تأثير سلبي علي الأداء الإنتاجي وصفات الذبيحة والوظائف الفسيولوجية والكفاءة الاقتصادية.