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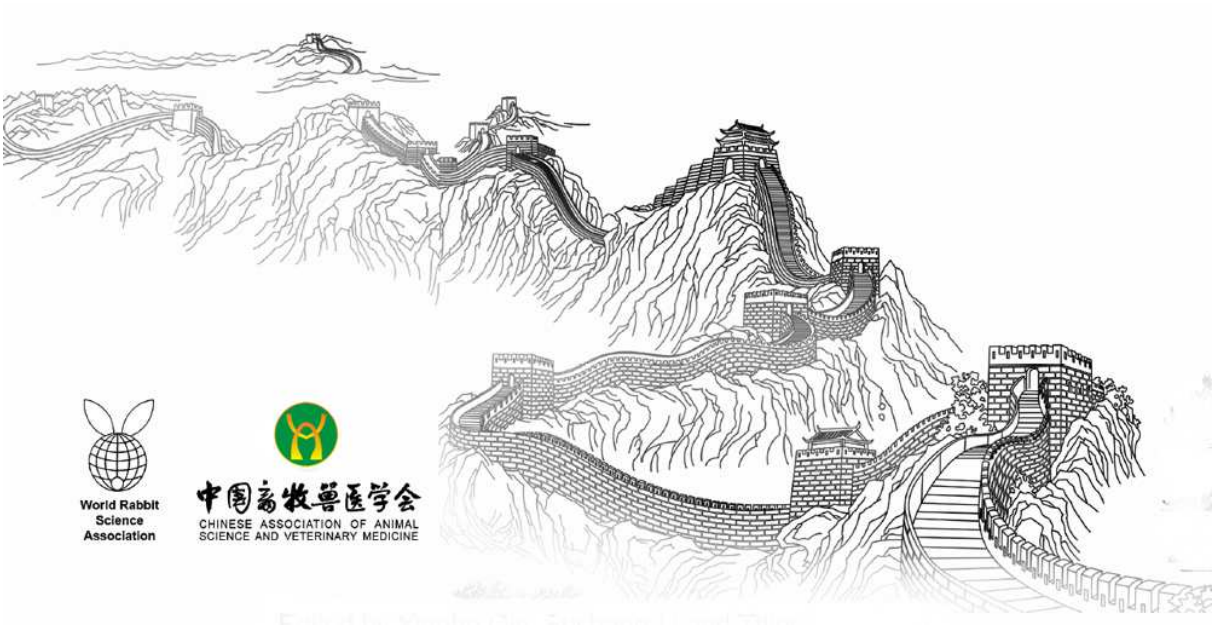

EFFECT OF USING LOW PROTEIN DIET WITH IRRADIATED TOMATO POMACE ON GROWTH PERFORMANCE OF GROWING NEW RABBITS

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ABSTRACT

The present study aimed to investigate the growth performance of growing New Zealand White (NZW) rabbits fed with low protein diets containing irradiated or un-irradiated tomato pomace (TP). Eighty unsexed NZW rabbits were divided randomly into four experimental groups of 20 rabbits of 5 weeks age with an average live body weight of (603.6 ± 10gm). Four experimental diets were obtained: (1) Control diet (C) containing 15.0% CP; (2) (TP0) containing 20 % TP; (3) Irradiated 20 % TP at dose of 15 KGY (TP15) and (4) Irradiated 20 % TP at dose of 25 KGY (TP25). Tomato pomace was higher in organic matter (OM), ether extract (EE), crude fiber (CF), calcium and phosphorus than SBM. Crude fiber, NDF, ADF and ADL were reduced by 3.04, 3.59, 4.20 and 10.13%, respectively, at dose of 15 KGY as compared with un-irradiated tomato pomace (TP0). The daily weight gain was significantly decreased in the rabbits fed TP0 diet as compared with those fed (C) diet. The mortality rate was increased from 15 to 30% as the doses of gamma irradiation increased from 0 (TP0 diet) to 25 KGY (TP25 diet). The inclusion of 20 % TP in rabbit diets resulted the cheapest diet as compared with C diet. It could be concluded that it is possible to replacement Irradiated tomato pomace (TP) at dose of 15 KGY in rabbit's diet instead of soybean meal up to 20 % without any significant differences.

Key words: Rabbit diet, Low protein, Tomato pomace (TP), Irradiated, Kilo Gray (KGY)

INTRODUCTION

Feed is the highest cost in rabbit production, representing at least 65%. Therefore, one of today's real challenges for rabbit feed formulation is to produce an efficient combination of feedstuffs that will meet rabbit's nutrient requirements, reduce feed cost and increase the net revenue to the producer. Protein is the most expensive component in diets which commonly depends on traditional sources of protein as soybean meal (SBM) which recently deficiency in its quantity and quality. So there is need to find nontraditional sources of protein to solve food shortage problems and produce cheap diet.

The tomato pomace serves as an excellent example. The total waste produced from tomatoes from world production was estimated roughly to be 11 million ton/year (FAO, 2011). Tomato pomace (TP) is a mixture of tomato skin, pulp and crushed seeds that remain after the processing of tomato for juice, paste and/or ketchup. This by product remains from squeeze of tomato is rich in protein, energy and crude fiber. In addition, it contains more essential amino acids for rabbits as compared with alfalfa hay of good quality (Ahmed et al., 1994). Abdel-Baset and Abdel-Azeem (2009) reported that the dried TP can be substituted in the diets of rabbits up to 20% without any adverse effect on the performance and carcass traits beside it have an economical value.

Therefore, the present study was conducted to investigate the growth performance of rabbits fed low protein diets containing irradiated and non-irradiated tomato pomace (0, 15 and 25 KGY).

MATERIALS AND METHODS

The experiments of the present study were carried out at commercial Farm, during the period from January 2012 to March 2012. Eighty unsexed NZW rabbits were divided randomly into four experimental groups of 20 rabbits each of 5 weeks of age with an average live body weight of (603.6 ± 10gm), were used in this study. Rabbits were housed in galvanized wire cages with flat deck (50 x 50 x 40 cm) two rabbits in each cage. All cages were equipped with feeding hoppers made of galvanized steel sheets with automatic drinkers with nipples for drinking. Feed and water were offered ad-libitum throughout the experimental period. Rabbits of all groups were kept under similar conditions of management.

Prepare tomato pomace and Radiation processing:
The tomato pomace was obtained from Al-Ain Food factory for nutritional products in Sadat City, Al Menoufiya Governorate. The residue was sun dried for several days and packed in well-sealed polyethylene bags, each contained 2kg and then exposed, at room temperature to gamma irradiation at doses of 0, 15 and 25 KGY. The source of irradiation was 60Co gamma cell (at dose rate of 256.4 rad/sec) located at the National Center for Radiation Research and Technology, Nasr City, Cairo, Egypt. The dose was monitored by radiochromic film**.** Three samples were taken for proximate chemical analysis.

Experimental Diets:
The experimental diets were formulated to cover all essential nutrient requirements for growing rabbits according to De Blas and Mateos (1998). Four experimental diets were obtained: (1) Control diet (C) containing 15.0% CP. (2) (TP_0) containing 20 % TP. (3) Irradiated 20 % TP at dose of 15 KGY (TP_{15}) and (4) Irradiated 20 % TP at dose of 25 KGY (TP_{25}).

Table 1: Formulation and chemical analysis of experimental diets:

	Diets			
Ingredient	**C**	**TP_0**	**TP_{15}**	**TP_{25}**
Barseem hay	28.5	0	0	0
Barley	36.0	21.7	21.7	21.7
soybean meal 44%	10.50	2.0	2.1	2.2
wheat bran	18.6	50	49.9	49.8
tomato pomace	0	20	0	0
TP 15KGY	0	0	20	0
TP 25 KGY	0	0	0	20
l-lysine	0.2	0	0	0
Molasses	3	3	3	3
Limestone	0.8	2.5	2.5	2.5
Di-Calcium	1.6	0	0	0
Methionine	0.30	0.3	0.3	0.3
Premix(1)	0.3	0.3	0.3	0.3
Salt	0.2	0.2	0.2	0.2
Total	**100**	**100**	**100**	**100**
Chemical Analysis (%):				
Dry matter (DM)	86.2	85.8	86.1	85.9
Ash	5.41	5.05	5.04	5.01
Crude protein (CP)	15.0	15.1	15.2	15.1
Crude fiber (CF)	12.70	13.10	12.91	12.70
Digestible energy (DE) (kcal/kg)(3)	2447	2447	2448	2449
NDF	29.10	33.81	33.50	33.21
ADF	15.80	13.01	12.81	12.70
ADL	3.43	3.54	3.38	3.28
Ether extract (EE)	1.61	3.35	3.27	3.22
Starch((2)	21.80	20.61	20.71	20.51
Calcium((2)	1.15	1.15	1.15	1.15
Phosphorus(2)	0.77	0.78	0.78	0.78
Methionine(2)	0.47	0.49	0.49	0.49
Lysine(2)	0.85	1.00	1.00	1.01

1) Premix produced by Pestar Company, China. Each 3 Kg vitamin and mineral mixture contain: Vitamin A 12000000 IU, Vit.D3 2200000 IU, Vit. E 10000 mg, Vit.K,2000 mg, Vit.$B_1$1000mg, Vit.$B_2$4000mg, Vit.$B_6$1500mg, Vit.B_{12}10mg, Pantothenic Acid 10000mg, Niacin 20000mg, Biotin 50 mg, Folicacid 1000mg, Choline chloride 500gm, Selenium 100mg, Manganese 55000mg, Zinc 50000mg, Iodine 1000 mg and carrier CaCO3, to 3000 gm.
2) Calculated according to De Blas and Mateos (1998)

Chemical analysis:
At first, hard faeces was dried at 60ºC for 48 hr. to determine Dray Matter (DM), while DM of diets were performed using an air oven at 135ºC for 2 hr. Chemical analysis were carried out for diets and hard faeces, according to methods of AOAC (1995) for ash, Crud Protein, Crud Fiber and Ether Extract. Gross energy was determined in an adiabatic bomb calorimeter in Animal and Poultry Nutrition and Production Department, National Research Center, Dokki, Cairo, Egypt. Nutrient digestibility coefficients were calculated as described by Perez et al. (1995).

Statistical analysis:
Data were subjected to analysis of variance, using the general linear GLM procedure (SAS, 1998). The application of the least significant ranges among the different treatment means was done according to Duncan (1955).

RESULTS AND DISCUSSIONS

Comparison between chemical composition of soybean meal and tomato pomace:
The comparison between chemical composition of tomato pomace (TP) and soybean meal (SBM) showed that TP was higher in organic matter (OM), ether extract (EE), crude fiber (CF), calcium and phosphorus than SBM, but it was lower in crude protein (CP), ash, lysine, methionine and digestible energy (DE).

Effect of gamma irradiation on chemical composition of tomato pomace:
Results revealed that gamma irradiation treatment at both doses used (15 and 25 KGY) had no significant effect on DM, CP, EE, ash and cellulose contents of TP. The fibrous fractions of the TP significantly decreased with increasing the level of irradiation. Crude fiber, NDF, ADF and ADL were reduced by 3.04, 3.59, 4.20 and 10.13%, respectively, at dose of 15 KGY. The same trend was found at dose of 25 KGY for CF, NDF, ADF and ADL, which decreased by 5.53, 6.55, 5.94 and 16.46%, respectively, as compared with un-irradiated TP. These results were similar to the findings obtained by Amber *et al.* (2004) who found that gamma irradiation at 25 and 50 KGY decreased the fibrous fractions (CF, NDF and ADF) of rice bran. It could be observed that gamma irradiation at 25 KGY had a significant effect ($P< 0.05$) on hemicelluloses content (non-starch polysaccharides), without any effect on cellulose content.

Table (2): Effect of experimental diets on growth performance of growing NZW rabbits from 5 to 13 wks of age:

Parameter	C	TP_0	TP_{15}	TP_{25}	SEM	Sig.
Initial Body Weight (g)	608	607	605	609	7.93	NS
Final Body Weight (g)	2371^{a}	2272^{b}	2331^{a}	2205^{c}	15.43	***
Daily Weight Gain (g)	31.4^{a}	29.7^{b}	30.9^{a}	28.5^{c}	0.28	***
Feed Intake (g/d)	114.0^{a}	110.0^{b}	115.1^{a}	108.4^{c}	0.76	***
Feed Conversion Ratio	3.63^{b}	3.71^{ab}	3.74^{a}	3.81^{a}	0.040	**
Relative Growth Rate	118.1^{a}	115.6^{ab}	117.9^{a}	113.3^{b}	0.90	**
Performance Index (%)	65.5^{a}	61.4^{bc}	62.6^{b}	58.0^{c}	0.91	***
Mortaility (%)(1)	10^{b}	15^{b}	25^{a}	30^{a}	-	-

C: low protein diet, TP_0: tomato pomace diet, TP_{15}: irradiated tomato pomace diet (15 KGY), TP_{25}: irradiated tomato pomace diet (25 KGY).
SEM = Standard error of means, Sig. = significance, ***: Significant at 0.1% level of probability
**: Significant at 1% level of probability, NS Non-significant.
$^{a, b, c, d, e,}$ Means in the same row the different superscripts are significantly different ($P<0.05$).
(1) Chi-square test

Effect of experimental diets on growth performance:
Final body weight (FBW) was significantly decreased ($P<0.001$) by 4.2% in rabbits fed TP_0 diet compared with the group fed C diet. This may be due to change the source of protein in the diets. However, no significant differences between rabbits fed TP_{15} diet and those fed C diet could be observed. The FBW was significantly increased by 2.6% and then decreased ($p<0.001$) by 2.9% in the rabbits fed TP_{15}, TP_{25} diets, respectively, when compared with those fed TP_0 diet.

Also, daily weight gain (DWG) was increased (P<0.001) by 4.0% as the doses of gamma irradiation increased from 0 (TP_0) to 15 KGY (TP_{15} diet) and then decreased (P<0.001) by 4.0% at the dose 25 KGY (TP_{25} diet). The growth rate (GR) and performance index (PI) were significantly increased in the rabbits fed TP_{15} diets and then decreased (P<0.001) in those fed TP_{25} diet as compared with rabbits fed TP_0 diet. Our results reported here are in agreement with data obtained by Amber *et al*. (2004) who found that growth performance was significantly improved in growing rabbits fed diets containing irradiated rice bran at doses of 25 and 50KGY.

During the whole period (5-13 weeks of age), feed intake was decreased (P<0.001) by 3.5% in the rabbits fed TP_0 diet compared with those fed C diet. The reduction in feed intake may be due to change the source of protein. Feed intake was increased (p<0.001) by 4.6 % in the rabbits fed TP_{15} diets and then decreased (P<0.001) by 1.5% in those fed TP_{25} diet as compared with TP_0 diet. This result is in agreement with those obtained by Waheed (2005) who reported that feed intake was increased as the level of TP increased from 0 to 25 % in rabbit diets. The irradiation of TP did not affect the FCR. There were no significant differences among the rabbit's feed TP_0, TP_{15} and TP_{25} diets.

Mortality rate was increased from 15 to 30% as the doses of gamma irradiation increased from 0(TP_0 diet) to 25KGY (TP_{25} diet). This increase in the mortality rate may be due to high level of starch which produces a severe diarrhea as a result of low starch digestion at ileum by young rabbits because their enzymatic equipment is not completely developed (Gidenne *et al*., 2010).

CONCLUSIONS

It could be concluded that it is possible to replacement Irradiated tomato pomace (TP) at dose of 15 KGY in rabbit's diet instead of soybean meal up to 20 % without any significant differences. Thus, it is possible to include up to 20% TP in growing rabbit diets, more research is needed to evaluate the another dose of irradiated TP in the rabbit diets.

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