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GROWTH PERFORMANCE OF GROWING RABBITS AS AFFECTED BY DIETS CONTAINING DIFFERENT LEVELS OF GUAVA BY- PRODUCT (*Psidium guajava)*

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ABSTRACT

A total thirty six New Zealand White (NZW) male rabbits, 5 weeks of age were used in this study to investigate the effect of a partial replacement of berseem hay and barley in commercial basal diet with Guava by-product (Psidium guajava), as untradional feedstuff, at three levels (5, 10 and 15%) on growth performance, digestibility coefficients of nutrients, some carcass traits and economic efficiency.

The rabbits were randomly divided into 4 experimental groups (9 rabbits each). The 1st group was fed a pelleted basal diet, while the 2nd , 3rd and 4th groups were fed a diets containing 5, 10 and 15% Guava by-product, respectively. The experimental period was extended for 6 weeks.

Obtained results indicated that growth performance parameters had no adverse effect when experimental diets included up to 10% Guava by-product, while the main significant improvement in final body weight , total body weight gain, average daily gain and performance index were achieved for rabbit fed diets containing at level 5% Guava by-product.

On the other hand, daily feed intake, feed conversion, protein efficiency ratio (PER), carcass traits or caecum parameters had not significantly affected. However, the rabbits which fed diets containing 15% Guava by-product were recorded depression in these criteria.

Digestibility coefficients of DM, CF, EE, NFE and the nutritive values of the experimental diets were not affected by inclusion of Guava by-product in the diets, while the digestibility coefficients of OM or CP had significant depression when the diets included 10 or 15% Guava by-product.

In point the economical values, the highest economical efficiency (%) was recorded for rabbit group fed a diet contained 5% Guava by-product.

Key words: Rabbits, Guava by-product, performance, digestibility, carcass traits, economic efficiency.

INTRODUCTION

Rabbits are herbivorous animals consuming high roughage diets based on grass, lucerne, alfalfa and many other forage crops (El-Hindawy *et al*., 2003). Since, the principle factor affecting the annual profit margin is the cost of feeding, it is

necessary to seek for non- traditional and cheaper feedstuffs to decrease the feeding cost.

Additional, shortage of feedstuffs is one of the major limiting factor for increasing animal and poultry production.

Incorporation of cheap untraditional feedstuffs such as the agro–industrial by-products in the animal diets substantially participates in solving the problem and decreases the cost of feed, which in turn decreases the marketing price of rabbit production,(Shqueir and Qwasmi, 1994).

As a herbivorous and semi- ruminant animals the nutrient requirements for rabbits are still questionable and under investigation (Cheeke, 1987). There was no available literature on using Guava by-product in rabbit feeding Abd-Alla (1993) recorded a good intake for broiler fed Guava by-product (during the finisher period), without any harmful effect on health of performance parameters.

In Egypt, 243434 ton/ year of Guava fruit are produced (Egyptian Ministry of Agriculture, 2005). Guava by-product (GBP) is the residue of juice extraction of the fruit and estimated to be 30% of the original quantity.

Therefore, the aim of this study is to investigate the possibility of incorporating different levels of Guava by-product in growing rabbit diets, and their effects on growth performance, nutrients digestibility and nutritive values, carcass traits and economic efficiency under Egyptian conditions.

MATERIALS AND METHODS

The present study was conducted at a Private Rabbitry farm (Daltex Company, El-Mollack Valley) Sharkeia Governorate, during September and October 2005. The experiment work was extended for 6 weeks.

A total number of 36 male New Zealand White (NZW) rabbits of 5 weeks old with an average body weight nearly similar (639.98 ± 15.73) were divided into four experimental groups. Guava by-product was collected from Kaha Company and dried at 70°C for 24 hours, then ground well mixed (the price of one ton 200 LE).

The first group was fed a pelleted basal diet (without Guava by-product) while second, third and fourth groups were fed an pelleted diets contained 5 , 10 and 15 % Guava by-product, respectively, in replacement berseem hay and Barley (from 5 up to 11 weeks of age) .

Feed ingredients and chemical composition of the experimental diets are presented in Table (1). Guava by-product, berseem hay and barley were analyzed according to A.O.A.C. (1990).

The rabbits were housed (each of 3 together) in wire cages (60 x 55x 40 cm) provided with galvanized feeders and nipple drinkers. Feed and fresh water were daily offered to rabbits *ad libitum*. Individual live body weight, daily body weight gain, feed intake and feed conversion rate were weekly recorded. All the rabbits were kept under the same managerial, hygienic and environmental conditions.

The following parameters such as weight gain, feed intake, feed conversion (g feed / g gain) and protein efficiency ratio (PER) were calculated during the

Table 1 : Ingredients and chemical analysis of the experimental diets

Items	Guava by-product levels			
	Control	**5 %**	**10 %**	**15 %**
Guava by-product	00.00	05.00	10.00	15.00
Berseem hay	20.00	16.00	12.00	10.00
Barley	30.00	30.00	26.00	24.00
Yellow corn	5.30	5.30	5.30	5.30
Wheat bran	22.00	21.00	24.00	23.00
Soybean meal	16.00	16.00	16.00	16.00
Molass	5.00	5.00	5.00	5.00
Limestone	1.00	1.00	1.00	1.00
Salt	0.35	0.35	0.35	0.35
Vitamins + Minerals*	0.30	0.30	0.30	0.30
D . L Methionine	0.05	0.05	0.05	0.05
Total	**100.00**	**100.00**	**100.00**	**100.00**
Chemical analysis(% on air dry basis):				
Dry mater %	90.67	91.43	91.47	91.63
Organic matter %	80.78	81.58	81.40	80.81
Crude prtein %	15.99	15.93	15.95	15.85
Digestible energy (Kcal / Kg)**	2760.30	2751.10	2721.00	2700.00
Ether extract %	2.39	2.75	3.20	3.58
Crude fiber %	10.40	11.30	12.40	13.65
Nitrogen free extract %	52.00	51.60	49.85	47.73
Ash %	9.89	9.85	10.07	10.82
Calcium (Ca) %**	0.85	0.82	0.83	0.86
Phosphorus (P) %**	0.42	0.41	0.40	0.43
Lysin **	0.63	0.62	0.60	0.61
Methionine + cyst **	0.65	0.65	0.60	0.59

***Each kilogram contains:** Vit. A 2000000 IU, Vit., D3 150000 IU, Vit. E 8.33 g. Vit. K.0.33 g, Vit. B1 0.33 g, Vit. B2 1.0 g, Vit. B6 0.33g, Vit. B12 1.7 mg, Pantothenic acid 3.33g, Niacin 8.33 g, Biotin 33 mg, Folic acid 0.83 g, Choline choloride 200 g, Zn 11.79 g, Fe 12.5 g, Cu 0.5g, Co 1.33 mg, Se 16.6 mg, Mg 66.79 mg and Mn 5.0 g.

** Calculated according , NRC (1977).

experimental period (5 to 11 weeks of age). Economic efficiency was calculated as follows equation :

Economic efficiency (E E) = (A- B) / B × 100

Where: A = Price of Kg gain in Egyptian pound (L.E), B= Feed cost per Kg gain (L.E).

Performance Index (PI) was calculated according to **North (1981)** as follows equation: Performance Index = live weight (Kg) / Feed conversion × 100.

Slaughter trial :

At 11 weeks of age, three rabbits from each group were slaughtered and carcass traits were recorded by the standard technique according to Ckeeke *et al.* (1982).

At the end of the experimental periods (11 week of age), four digestibility trials were conducted by using three male rabbits from each treatment group which were housed individually in metabolic cages .

The experimental period was considered as a preliminary period followed by 6 successive days collection period according to the European reference method for rabbit digestion trails (Perez *et al.*, 1995).

The composite samples of Guava by-product, diets offered and faeces output were chemically analyzed according to A. O. A. C. (1990) for crude protein, crude fiber, either extract, nitrogen- free extract and total ash.

DE (kcal/kg diet) values of the experimental diets were calculated according to the equation described by Schiemann *et al*. (1972) as follows:

DE (kcal/kg diet) = 5.28 (DCP g/kg) + 9.51 (DEE g/kg) + 4.2 (DCF + DNFE g/kg) + 0.3.

The total digestible nutrients (RDN) values of the diets were calculated by multiplying the digestible ether extract (EE) by factor 2.25 and multiplying each of digestible crude protein (CP) , crude fiber (CF) and nitrogen free extract (NFE) by the factor 1.0.

Data of the experiment for all the variable were – subjected to statistical analysis according to Snedecor and Cochran (1982) by using SPSS system (1998). The difference between means were tested using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of (GBP):

A detailed chemical analysis of (GBP) used in the present study is shown in Table 2. The chemical composition of Guava by-product was nearly similar to the values given by Abd-Alla (1993), who found that raw guava by-product (RGP) contained 9.08% CP, 10% EE, 39.5% CF, 32.97% NFE, 2.55% CA, 0.38% calcium and 0.10% total phosphorus.

However, data indicated that GBP has adequate nutrients that could be used in rabbit diets when compared to berseem hay and barley. Feed ingredient and chemical analysis of the experimental diets according to NRC (1977) are presented in Table 1.

Growth performance and feed utilization:

Results in Table 3 show that final body weight at the end of the experiment were 1591.87, 1679.64, 1577.93 and 1535.41 g for rabbits fed diets contained 0, 5, 10 and 15% GBP, respectively. The level of 5% GBP in the diet resulted the heavier significant live body weight, while, 15% GBP in the diet had the lowest significant live body weight.

Total weight gain and average daily body gain took the same trend of line body weight and the best significant gain was achieved when the diets included 5% GBP compared with control or other diets. The same trend had been reported by Ghazalah and El-Shahat (1994) they found a significant increase in live body weight and weight gain of rabbits fed olive kernel meal (OKM) replaced 50% of barley, while it reduced significantly when (OKM) were replaced 75 and 100% of barley. Abd El-Galil (2001) found also, that body weight gain of growing rabbits decreased by increasing olive pulp meal level more than 10% during (5-9 weeks of age) and 15% during (9-13 weeks of age).

On the other hand, data showed that no significant differences in daily feed intake, feed conversion and PER when rabbits were feed diets included from 5% up to 15% GBP compared with control diet. However, insignificant improvements in these criteria were observed when experimental diet contained 5% GBP. These results agree with those obtained by Mousa and Abdel-Samee (2002) who did not find significant difference in feed intake of growing rabbits feed diets containing (0.0, 10 and 20% olive pulp). Also, El-Kerdawy (1997) in earlier studies found that, daily feed consumption for rabbits fed diets containing 0.0, 5.0, 10.0 and 15.0% olive pulp did not differ significantly.

Nutrients digestibility and nutritive values:

The results in Table 4 showed that, digestibility coefficients of OM and CP for growing rabbits fed control diet or including 5% GBP were significantly ($P<0.5$) better than obtained by rabbits fed diets contained 10 or 15% GBP. Abd-Alla (1993) suggested that Guava waste incorporate pectin, which, reduce protein utilization.

However, the digestion coefficient values of DM, CF, EE and NFE did not differ among treatment groups. The same results reported by Hatem (2003) where, concluded that apparent digestibility of CP and CF for rabbits fed diets contained 5%-10% olive cake did not reduce as compared to control, while, those contained 15% or 20% olive cake were significantly decreased ($P<0.05$). However, digestibility of DM, OM, EE and NFE were insignificantly affected by aforementioned levels of olive cake.

From the data in Table 4, it could be noticed that, the digestibility of nutritive values as DCP, TDN and DE were significantly decreased with increasing GBP level up to 15% in the experimental diets.

These results agree with those obtained by Ismail and Gippert (1999) using different levels of sunflower–cake diets of growing NZW rabbits.

Slaughter traits:

Data of slaughter test of rabbits fed diet contained different levels of GBP in Table (5), did not show any significant differences for dressing weight, carcass weight, giblets weight percentages or caecum parameters [Length- circum ference-full weight (g)]. These results agree with those reported by El-Kerdawy (1997) and Zaza *et al.* (2001). They reported no significant differences in carcass traits for rabbits consumed diet including 5, 10, 15% and 20% olive cake.

Similar results were obtained by Soad *et al*. (1994) who found that, no differences in the percentages of each of carcass, giblets and alimentary tract weights when rabbit diets contained 0.0, 10., 20 and 30 % tomato pomace.

Moreover, El-Manylawi (2005) concluded that, rabbit groups fed on diets contained 3, 6 or 9% of geranium or spearmint by-product did not differ significantly as compared to control group in empty carcass, giblets and dressing percentages.

Economic evaluation:

From the economical point, costs of feed / kg gain were 3.65, 3.68 and 3.76 L.E. for rabbits fed the diets which contained 15%, 5% and 10% GBP, respectively (Table 6). While, that fed control diet was recorded the highest feed cost. (4.03 L.E). Performance index (PI) for the experimental rabbits group fed diet contained 5% GBP at level 5% had achieved the best significant value, while, that contained GBP at level 15% recorded the lowest significant value. Also, the best relative economical efficiency (129.58%) was achieved by diet contained 5% GBP as compared with control diet (100%), under Egyptian conditions.

Conclusion:

Results of this study concluded that guava by-product *(Psidium guajava)* could be included up to 5% in diets of growing NZW rabbits in place of berseem hay and barley without any adverse effects on their growth performance and nutrients utilization, under Egyptian conditions.

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معدل أداء الأرانب النامية المغذاة على علائق تحتوى على تفل الجوافة

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معهد بحوث الإنتاج الحيواني - مركز البحوث الزراعية - الدقى - الجيزة .

- استخدم فى هذه الدراسة ٣٦ ذكر أرنب نامى من نوع النيوزيلندي الأبيض عمر (٥) أسابيع فى تجربة (استمرت لفترة ٦ أسابيع) لدراسة تأثير الاستبدال الجزئي لكل من دريس البرسيم والشعير فى علائق الآرانب النامية بتفل الجوافة كمصدر غير تقليدي فى تغذية الأرانب على معدل الأداء ومعاملات الهضم وبعض صفات الذبيحة والكفاءة الاقتصادية
- قسمت الآرانب عشوائياً إلى [٤] مجاميع تجريبية متماثلة تقريباً بمتوسط وزن ٦٣٩.٩٨ جم (تحتوى كل مجموعة على ٣ مكررات) حيث استخدم [٤] مستويات إحلال من مخلف تفل الجوافة هى [صفر ، ٥ ، ١٠ ، ١٥ %] من دريس البرسيم والشعير وكانت جميع العلائق التجريبية متماثلة تقريباً فى قيمتها الغذائية [١٥.٨٥ – ١٥.٩٩ % بروتين خام ، ١٠.٤٠ -- ١٣.٦٥ % ألياف خام ، ٢٧٠٠ – ٢٧٦٠ ك كالورى طاقة مهضومة / كجم].

أوضحت النتائج ما يلي :

(١) احتواء علائق الأرانب على تفل الجوافة بنسبة تصل إلى ١٠ % لم يؤثر سلباً على معدلات أداء الآرانب النامية .

(٢) أفضل تحسن معنوي فى (وزن الجسم ، الزيادة فى النمو ، متوسط النمو اليومي، دليل الأداء) تم الحصول عليه عند مستوى إضافة ٥ % تفل جوافة . وفى المقابل سجلت نفس هذه القياسات انخفاضاً معنوياً عندما وصلت نسبة الإضافة إلى ١٥ % تفل جوافة بينما لم نلاحظ أى فروق معنوية نتيجة المعاملات فى كل من كمية الغذاء المستهلك أو معدل التحويل الغذائي أو معدل الاستفادة من بروتين الغذاء.

(٣).معاملات الهضم لكل من المادة الجافة والألياف الخام والدهن الخام والمستخلص الخالي من النتروجين لم تتأثر معنوياً بإضافة تفل الجوافة للعلائق . بينما انخفض معامل الهضم معنوياً لكل من المادة العضوية والبروتين الخام عند إضافة تفل الجوافة بمستويات ١٠ أو ١٥ % - على أي حال لم تتأثر القيم الغذائية لكل من البروتين المهضوم والمركبات المهضومة الكلية والطاقة المهضومة باحتواء العلائق على تفل الجوافة .

(٤) لم تسجل أى اختلافات معنوية لقياس الذبيحة و الأعور نتيجة استخدام العلائق التجريبية مقارنة بعليقة الكنترول

(٥) تحسن العائد الاقتصادي نتيجة إضافة ٥ أو ١٠ أو ١٥ % تفل جوافة للعلائق التجريبية بينما كانت أفضل كفاءة اقتصادية سجلت للمجموعة التي غذيت عليقه احتوت ٥ % تفل جوافة .