Egyptian Journal of Rabbit Science, 20 (1) 15 – 30 (2010)

PERFORMANCE OF NEW ZEALAND WHITE RABBITS FED ON BIOLOGICALLY TREATED POTATO VINES.

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This experiment was conducted to study the possibility of wheat bran replacement by biologically treated potato vines (BTPV) at level of 50%or 100% in growing New Zealand White (NZW) rabbit diets to study its effects on growth performance, nutrients digestibility, carcass characteristics and economic efficiency. Sixty three weaned New Zealand White rabbit, six weeks old with an average live body weight from 750 to 780 g were randomly divided into seven groups (nine rabbits each). Each group was divided into three replicates, (three rabbits each). The result showed that degradation of glycoalkaloids was more efficient when Lactobacillus acidophilus + Trichoderma viridi were incubated on potato vines at 30°C for 21 days. Data showed that rabbits fed diets containing 50% biologically treated potato vines (BTPV) by (Trichoderma viridi, Lactobacillus acidophilus and Lactobacillus acidophilus + Trichoderma viridi) or 100% biologically treated potato vines (BTPV) by Lactobacillus acidophilus had the best live body weight, body weight gain, feed conversion, digestion coefficient, nutrient value and the best weight of empty carcass and dressing percentage at 14 weeks of age when compared with the control or other groups. Groups fed 50% or 100% BTPV by lactobacillus achieved the highest economic efficiency and relative economic efficiency. The results indicated the feasibility of using biological treated potato vines with to replace wheat bran at levels of 50 or 100% in pelted diets for growing rabbit to reduce fed costs without harmful effects.

Key words: Biologically treated, potato vines, glycoalkaloids, wheat bran, rabbits, growth, digestibility, and carcass traits.

The shortage in feedstuffs is considered the main problem facing the development of animal production, in Egypt,. Mean time, there are large quantities of non- utilized residues of crops , vegetables and fruits such as potato vines, pea vines, watermelon leaves and tomato leaves.

Vegetable leaves are the cheapest contents of essential amino acids, vitamins and minerals. But, the presence of inherent toxic factors or anti-nutritional components in plants is considered one of the major obstacles in harnessing the full benefits of the nutritional value of plant foods and vegetables (Lewis and Fenwick, 1987). Nightshade Family *(Solanaceae)* include Tomatoes (*Lycoperscion esculentum*), potatoes (*Solanum tuberosum*) and eggplants (*Solanum melongena*) leaves contain glycoalkaloids that are toxins .Mechanisms of steroidal glycoalkaloid toxicity in humans and mammals are similar and generally of two types: (1) inhibition of acetyl-cholinesterase and butryl-cholinesterase activities in the central nervous system and (2) disruption of cell membranes in the digestive system (Krasowski *et al.*, 1997). Glycoalkaloids concentration in the foliage of the *Solanum* species was estimated to be between 110 and 890 mg/100 g fresh weight (Vaananen,2007). *Solanum* species have been analyzed for glycoalkaloids α solanine, α chaconine, α tomatine, demissine, solamargine, and solasonine (Schreiber, 1968). Therefore, methods like as physical, chemical, physicochemical and biological treatments are essential for improving the nutritive value of such by-products. Some disadvantages of these methods, such as nutritional loss, sensory quality reduction and high cost of equipment, have limited their practical applications (Gowda *et al.*, 2007). However, the biological treatments are used to reduce anti-nutritional factor by using certain fungi, such as *A. parasiticus,* in degrading aflatoxins, possibly through fungal peroxidases. Fermentation with yeasts has also found to be effective in destroying patulin and rubratoxin B (Lopez-Garcia and Park, 1998). Also, Oda *et al.* (2002) reported that filamentous fungi which have been isolated from potato sprouts is able to produce an enzyme has degrading ability to glycoalkaloids.

The present study was carried out to examine:

1-The possibility of glycoalkaloids antinutrional factors reduction in vegetable crop residues (such as, potato vines) by using biological treatments.

2-The possibility of replacing wheat bran by biological treated vegetable residues (potato vines) up to 50% or 100% in growing NZW rabbit diets and its effect on their growth performance, digestibility, nutritive value, and carcass quality as well as the economic feasibility.

MATERIALS AND METHODS

The experimental work of this study was carried out at El-Kanater El-Khayria, Kalyubia Governorate, Poultry Research Station, Animal Production

Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt, during the period from 12 October till 12 December 2009. The microbiological studies and chemical analysis were conducted at the Microbiology Laboratory of By-Products Research Department, Animal Production Research Institute, Giza, Egypt. Potato vines were obtained from El-Menoufia Governorate. The green potato vines moisture content was reduced by sun-drying from 85% to 9-10% during summer season, then ground by hammer mill and kept for subsequent processing. Fungi *(Trichoderma viridi),* Bacteria (*Lactobacillus acidophilus)* were the microorganisms for biological treatment.

The biological treatments:

Fungal strain (*Trichoderma viridi*) was obtained from the Microbiology Laboratory of By-Products Research Department, Animal Production Research Institute, Giza, Egypt. Inoculate of fungi were prepared by inoculating 250ml Erlenmeyer flasks containing 50ml of media (Nutrient glucose broth) in medium that autoclaved at 121°C for 15 minutes. The cooled sterilized medium was inculcated with 3 days age culture, and then incubated in a rotary shaker 150 rpm at 30°C for 48hrs. Sterilized ten liter Erlenmeyer flasks containing 8 liter of nutrient glucose broth medium and the flasks provided by aeration pump to facilitate aeration. The resulted culture was harvested and counted ($2x10^6$ cell/ml for *Trichoderma viridi.*), Bacteria (*Lactobacillus acidophilus*) strain was obtained from the Dairy Technology Department, Animal Production Research Institute, Giza, Egypt. The Inoculate of bacteria was prepared by inoculating 1liter Erlenmeyer flask containing 500 ml sterile Milk Permeate Medium and 0.01% yeast extract .The flasks were inoculated with 1% of freshly prepared culture. Maximum growth of the bacteria was obtained after 72h. Then inoculated into 10-liter Erlenmeyer flasks containing 8 liter of Milk Permeate Medium and the flasks was provided by aeration pump to facilitate aeration, the resulted culture was harvested and counted $4x10^7$cell/ml for *lactobacillus acidophilus).* Potato vines were separately packed in nylon bags after providing water then inoculated with

1-The Fungus culture (concentration was $2x10^6$cell/ml for *Trichoderma viridi*).

2-The Bacterial culture (concentration was $4x10^7$cell/ml for *lactobacillus acidophilus*).

3-The Bacterial culture and Fungus culture and incubated at 30°C for 21days then fermented potato vines was dried at 60°C over night and ground. Then samples were taken to determine glycoalkaliods level according to Sabri *et al.* (1973).

Diets and treatments:

Seven experimental diets were formulated, the first was representing the control diet (C) without adding potato vines while the other six diets were represented 50 or 100% of biologically treated potato vines replacing wheat bran as shown in Table 1. All the experimental diets were formulated to be iso-nitrogenous and iso-caloric, and to meet all the essential nutrient requirements of growing rabbits according to NRC (1977). Chemical analyses of non treated potato vines and biologically treated potato vines (BTPV) are presented in Table 2, while composition and chemical analyses of the experimental rations are presented in Table 1. Sixty three weaned New Zealand White (NZW) rabbits, six weeks old with an average live body weight from 750 to 780g were allotted randomly to seven groups (nine rabbits each). Each group was divided into three replicates, (three rabbits each). All animals were receiving control diet for one week before the start of the experimental period. Feed and water were offered *ad libitum.*

Growth performance:

Feed intake and weight gain were recorded weekly, while feed conversion was calculated accordingly as gram of feed against gram of gain. The experimental period lasted for 8 weeks. At the end of the experimental period, a digestibility trial was conducted to determine the digestibility coefficient of the nutrients according to Fekete (1985). Also, 3 animals from each group were slaughtered to study carcass characteristics. Head, heart, kidneys, and liver were weighed and dressing percentage were calculated according to Steven *et al.* (1981).as follows: _

Dressing % = dressing weight x 100 /pre slaughter body weight.

Where dressed weight = weight of empty carcass with head.

Chemical analysis:

Chemical analyses for determining moisture, CP, CF, EE, NFE and ash for feed, meat and feces were done according to the methods recommended by A.O.A.C (1990). Fiber fraction, neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined according to Van Soest *et al.* (1991).

Statistical analysis:

The experimental data were analyzed using general linear model using ANOVA procedures of SAS (1999). Means were separated using Duncan's (1955). Multiple range tests when the main effect was significant. using the following model:

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

Where: μ= Overall mean of Y_{ij}. T_i = Effect of treatment, I = (1,....7).e_{ij} =Random error . .

Table1.Composition and chemical analysis of the experimental diets (on DM basis).

Ingredients	Control	BTPV(%) Tricho.Vir. 50	BTPV(%) Tricho.Vir. 100	BTPV(%) Lacto. Acid. 50	BTPV(%) Lacto. Acid. 100	BTPV(%) Lacto.Acid+Tricho.Vir. 50	BTPV(%) Lacto.Acid+Tricho.Vir. 100
Clover hay	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Yellow corn	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Soybean meal	13.00	13.00	13.00	13.00	13.00	13.00	13.00
Wheat bran	28.00	14.00	--------	14.00	------	14.00	------
T.Potato vines	--------	14.00	28.00	14.00	28.00	14.00	28.00
Molasses	3.00	3.00	3.00	3.00	3.00	3.00	3.00
$CaCO_3$	1.00	1.00	1.00	1.00	1.00	1.00	1.00
salt	0 .50	0 .50	0 .50	0 .50	0.50	0.50	0.50
Premix*	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Chemical analysis (%)							
DM	88.5	88.2	88.5	88.8	88.7	89.0	88.4
OM	89.3	87.8	87.1	88.2	87.7	87.6	87.1
CP	16.25	16.68	16.9	16.5	16.8	16.45	16.8
CF	13.4	12.73	12.3	13.06	13.05	12.5	12.7
Ash	10.7	12.2	12.9	11.7	12.2	12.3	12.9
EE	2.52	2.49	2.49	2.46	2.43	2.04	2.71
NFE	45.63	44.1	43.51	45.08	44.2	45.71	43.29
Calculated digestible energy (DE)							
DE(Kcal/kg)**	2507	2529	2543	2518	2519	2536	2530

***Each kg of Vitamins &Minerals mixture contains:** Vit $_A$ 2.000.000 IU, Vit$_{D3}$ 150.000 ICU, Vit $_E$ 8.33g, Vit. $_K$ 0.33 g, Vit. $_{B1}$ 0.33g, Vit. $_{B2}$ 1.0g, Pantothenic acid 3.33g; Nicotinic acid, 30.00g; Vit. $_{B6}$ 2.00g; Vit $_{B12}$ 1.7 mg, Folic acid 0.83g,Biotin 33 mg, Cu 0.5g, choline choloride 200mg,Mn 5.0g, Fe 12.5g, Mg 66.7mg, Co 1.33 mg, Se 16.6 mg, Zn 11.7g,Iodine 16.6 mg and Antioxidant, 10.0g.

** DE calculated according to Cheek, (1987).DE = 4.36 – 0.0491 X NDF %.
NDF % = 28.92 + 0.657 X CF%

RESULTS AND DISCUSSION

Chemical composition:

The results in Table 2, showed that biological treatment had positive effects on improving the nutritive value of potato vines, since the protein and fat contents were increased. Ash content was increased as well. Increasing ash content may be attributed to the growth or degradation of organic matter of potato vines by microorganism in one hand and concentration of ash on the other hand (Fatma, 1998). Reduction in NFE could be related to the consumption of carbohydrates

Table 2. Chemical analysis of non-treated and biologically treated Potato vines (on DM basis).

Items %	Non treated potato vines	BTPV Tricho. Vir.	BTPV Lacto. Acid.	BTPV Lacto. Acid+ Tricho. Vir.
DM	92.3	91.79	91.88	91.7
OM	73.79	67.9	67.6	67.18
CF	12.2	9.48	10.25	10.53
CP	15.8	18.8	18.5	19.25
EE	1.66	1.85	2.46	1.95
Ash	26.21	32.1	32.4	32.82
NDF	31.2	29.74	30.72	30.12
ADF	22.96	20.2	22.1	20.71
ADL	6.89	6.84	6.89	6.74

by the microorganism as energy sources for their growth and multiplication. Martin (1977) stated that many bacterial genera are capable of utilizing steroids as a sole carbon and energy source, there by degrading steroids completely to carbon dioxide and water. These results were confirmed by those reported by Villas-Bôas *et al.* (2002). who reported that, biological treatment is used for increasing the nutritional value of many by-products, because they have significant concentrations of simple carbohydrates, such as mono-and disaccharides.

Glycoalkaloids content:

The result of glycoalkaloids content of non-treated potato vines was found to be 221.01 mg/100g dry vine as shown in Table 3. In this respect, Nicholson *et al.* (1987) found that the total glycoalkaloids levels in dry potato vines were 184 mg and 224 mg /100 g dry vine. Results given in Table 3 showed that glycoalkaliods content of potato vines as affected by (*Trichoderma virdi*), (*Lactobacillus*) and (*lactobacillus* + *Trichoderma*) were reduced to be 80.2, 73.6 and 56.2 mg/100g dry vines respectively. In this respect, Pilnik and Voragen (1993) found that *Trichoderma. harzianum* or *T.reesie, Asperqillus aculeatus, A.awamori, A. orvzae, A.iaponicus or A. niqer*and *Fusarium sp.* produce enzyme rhamnosidase. Which is Bushway *et al.* (1990) able to liberate the Rhamnose units from both alpha-solanine and alpha-chaconine (both being glycoalkaloids present in potato). And also, Keukens *et al.*, (1995) stated that removal of either of the rhamnose molecules from α-chaconine. destroys the ability of α-chaconine to disrupt membranes and so is likely to represent a detoxification event. Moreover, Vesela *et al.* (2003) found that $1.4\text{-}2.24 \times 10^{8}$

Table 3 Glycoalkaloids content in non-treated and biologically treated potato vines.

Items %	Non treated potato vines	BTPV Tricho.vir.	BTPV Lacto. Acid.	BTPV Lacto.Acid + Tricho. Vir.
Glycoalkaloids mg/100gdry potato vines	221.01	80.2	73.6	56.2

CFU/ml of *Lactobacillus plantarum 976H* degrades glycoalkaloids at temperature of 30°C for120h.

Growth performance:

As shown in Table 4, feeding growing rabbits on diets containing 50%BTPV by (*Tricho., Lacto.*, and *Lacto.+ Tricho.*) and 100% BTPV by *Lacto.* were significantly ($P<0.05$) increased the average final weight and average daily weight compared with the control group. These results are in disagreement with Abbott *et al.* (1990) who found that average final live body weight and average daily weight gain of mice did not significantly differ among groups fed diets containing fungal detoxified jojoba meal diets or jojoba meal detoxified with enzymes. In contrary, feeding animal biologically treated vegetable waste gave good results in the final weight and daily gain (Surzhilska *et al.*1986; Fatma, 2005). *Zaza et al.* (2005) found that average final live body weight and average daily weight gain of rabbits showed no significant differences among groups fed non-treated grape pomace or biologically treated grape pomace by (*Candida utilis* and *Rhodotorula glutinis*) replacing clover hay at levels of 25 or 50% of the control. Regarding feed consumption values, rabbits fed on diets containing 50% or 100% BTPV consumed significantly ($P\leq0.05$) less feed than control group. However, results of feed conversion ratio revealed that, rabbits fed on diets containing 50% BTPV by (*Tricho., Lacto.*,and *Lacto.+Tricho.*) and rabbits fed on diets containing 100% BTPV by *lacto.* were significantly ($P<0.05$) better than the control group. Similar results were reported by Abbot *et al.*, (1990) and Verbiscar *et al.* (1981) with fungal detoxified jojoba meal. Nicholson *et al.* (1987) found that when sheep and goats were fed potato vine silage, no problem with palatability or adverse effects of the glycoalkaloids in the vines was detected. Kumprecht *et al.* (1985) and Alwash and Dafaee(1987) reported that biological treatment improved feed efficiency for different tested animals. El-Katcha *etal.*(1988) found that kemzyme supplementation

Table 4. Effect of biologically treated potato vines on growth performance of New Zealand White rabbits.

Items	Control (0)	BTPV(%) Tricho.vir.		BTPV(%) Lacto.Acid.		BTPV(%) Lacto.Acid+Tricho.Vir	
		50	100	50	100	50	100
Initial L.B.W. (g)	780.7 ±24.4	758.06 ±19.0	760.1 ±17.5	750 ±14.7	764.06 ±16.6	760.3 ±9.75	760.1 ±7.21
Final L.B.W. (g)	1885.3^{b} ±11.08	1955.3^{a} ±9.75	1907.3^{b} ±10.3	1967.2^{a} ±10.3	1951.3^{a} ±9.75	1962.5^{a} ±8.37	1902^{b} ±12.5
Average daily gain/ (g)	19.7^{c} ±0.26	21.3^{ab} ±0.48	20.4^{bc} ±0.35	21.7^{a} ±0.40	21.2^{ab} ±0.03	21.4^{a} ±0.23	20.3^{bc} ±0.15
Average Feed intake g/h/d	89.8^{a} ±0.83	86.3^{bc} ±0.435	87.7^{b} ±0.52	85.6^{c} ±0.49	87.1^{bc} ±0.43	86.6^{bc} ±0.29	87.5^{b} ±0.53
Feed conversion (g feed/g gain)	4.55^{a} ±0.17	4.05^{bc} ±0.02	4.29^{ab} ±0.08	3.94^{c} ±0.30	4.10^{bc} ±0.11	4.04^{bc} ±0.02	4.31^{ab} ±0.05

a,b,c--- Means in the same row with different superscripts are significantly different ($P<0.05$).

tended to slightly improve feed efficiency of rabbits. Moreover, Fatma (2005) found that rabbits fed both additives mixture of effective microorganisms (EM1Bochashi) and a mixture of enzymes (Optizym) had the best feed conversion value compared with the control group.

In general, the absence of negative and adverse effects on growth performance of tested rabbits may be attributed to the reduction of glycoalkaloids content and neutralizing its toxic effect (Table 3) in tested potato vines through the microorganisms used in this current study. For rabbits, the intraperitoneal (i.p). LD_{50} dose (abbreviation for "Lethal Dose, 50%),is 50 mg/kg body weight for α-solanine (Jadhav *et al.*, 1981)

Nutrients digestibility:

The results in Table 5 indicated that feeding growing rabbits on diets containing 50% BTPV by (*Tricho., Lacto.*, and *Lacto.+ Tricho.*) significantly ($P<0.05$) increased the digestibility coefficients of DM,OM, CP, CF, EE and NFE compared with the control group. The same trend, feeding growing rabbits on diets containing 100% BTPV by *Lacto.* significantly increased the digestibility coefficients of DM, NFE and CP digestibility recorded significant increased by rabbits fed diets containing 100% BTPV by (*Lacto.* or *Lacto. + Tricho.)*

Table 5. Effect of biologically treated potato vines on digestion coefficient and nutritive value of New Zealand White rabbits.

Items	Control (0)	BTPV(%) 50	BTPV(%) 100 Tricho.Vir.	BTPV(%) Lacto.Acid. 50	BTPV(%) Lacto.Acid. 100	BTPV(%) Lacto. Acid.+Tricho. Vir. 50	BTPV(%) Lacto. Acid.+Tricho. Vir. 100
Digestion coefficient (%)							
DM	69.5^{c} ±0.46	72.1^{ab} ±0.63	71.0^{bc} ±0.46	73.2^{a} ±0.48	71.5^{ab} ±0.69	72.7^{ab} ±0.92	71.0^{bc} ±0.51
OM	70.2^{c} ±1.05	72.9^{ab} ±0.73	70.4^{c} ±0.54	73.9^{a} ±0.34	72.1^{abc} ±0.69	73.0^{ab} ±0.69	72.3^{abc} ±0.69
CP	70.5^{d} ±0.92	75.3^{b} ±0.46	72.02^{d} ±0.46	77.6^{a} ±0.43	73.9^{bc} ±0.57	77.6^{a} ±0.63	72.9^{c} ±0.75
CF	39.2^{b} ±0.86	42.6^{a} ±0.98	41.3^{ab} ± 0.98	43.8^{a} ± 0.96	41.0^{ab} ± 0.86	42.1^{a} ± 0.80	41.0^{ab} ± 0.83
EE	80.2^{c} ±1.15	82.5^{abc} ±0.63	81.2^{bc} ±0.75	83.9^{a} ±0.80	81.7^{abc} ±0.57	83.3^{ab} ±0.66	82.2^{abc} ±0.57
NFE	71.3^{c} ±0.57	76.4^{a} ±0.92	73.2^{bc} ±0.98	77.3^{a} ±1.03	74.8^{ab} ±0.80	76.8^{a} ±0.92	73.1^{bc} ±0.86
Nutritive value (%)							
DCP	11.2^{b} ±0.57	12.80^{a} ±0.46	11.6^{ab} ±0.28	13.05^{a} ±0.57	12.1^{ab} ±0.51	12.86^{a} ±0.20	11.6^{ab} ±0.57
TDN	71.1^{c} ±0.5	74.9^{ab} ±0.57	72.9^{bc} ±0.55	76.73^{a} ±0.46	73.7^{b} ±0.63	74.9^{ab} ±0.92	72.4^{bc} ±0.34
DE	3151.2^{e} ±24.3	3318.6^{abc} ±38.3	3238.3^{cde} ±33.2	3399.1^{a} ±23.5	3268.2^{bcd} ±38.3	3366.7^{ab} ±28.1	3207de ±35.7

a,b,c,d,e---Means in the same row with different superscripts are significantly different (P<0.05).

On the other hand, the other group fed diets containing 100%BTPV were insignificantly increased the digestibility coefficients of DM,OM, CP, CF, EE and NFE compared with the control group. As shown in Table 5, the nutritive values of DCP tended to be (P<0.05) higher when rabbits fed on diets containing of 50% BTPV. The same trend was observed with feeding growing rabbits on diets containing 50 % BTPV (*Tricho.*, *Lacto.*, and *Lacto.+ Tricho.*) and 100% BTPV by *Lacto.*. Results showed significantly (P<0.05) increased in the nutritive values of TDN and DE. It is worthy to notice that the improvement in weight gain and digestion coefficients which occurred in rabbits fed biologically treated potato vines by *Tricho., Lacto. and Lacto. + tricho.* may be due to the biological functions of reducing glycoalkaloids content in the potato vines to the safe and useful level as illustrated in Table 3. In this respect, Liu *et al.* (2004) reported that solamargine (component of glycoalkaloids), have anti-inflammatory effects and appear to act against herpes virus. Tenny (1996) reported that the biological functions of the *Lactobacillus acidophilus* is one bacteria essential in maintaining a healthy intestinal flora. Acidophilus is the primary friendly bacteria found in the intestinal tract and vagina. They help to protect the body from an invasion of *Candida* and other germs that invade and live in the body. *Acidophilus* bacteria also help by detoxifying some harmful substances in the gastrointestinal tract. Moreover, Soliman *et al.* (2000) reported that *lactobacillus* supplementation to rabbit diets tended to improve significantly ($P<0.05$) all the nutrients digestibility coefficients and gave the highest TDN value. These results are in agreement with Van Beek (1994) who found, improving digestibilities coefficient of nutrients due to addition of enzyme. Parfitt *et al.* (1982) observed that goats fed potato vine silage had lower in digestible dry matter, protein and cell walls than alfalfa silage. Also, El-Ashry *et al.* (2002), El-Sayed *et al.* (2002) and Aziza *et al.* (2003) showed that biological treatment enhanced the digestibility of all nutrients.

Carcass characteristics:

As presented in Table 6, it was clearly to notice that, rabbits fed on diets containing 50% BTPV by (*tricho., Lacto.* and *Lacto+tricho.*) and 100% BTPV by *Lacto.* had the best values ($P<0.05$) of empty carcass and dressing percentages compared with that of the control group. However, there were insignificantly differences in empty carcass and dressing percentages of the rabbit groups fed on diets containing 100% BTPV treated with (*Tricho.* or *Lacto. + Tricho.*) compared with that of the control group. These results are in disagreement with Zaza *et al.* (2005) who found insignificant differences in the carcass weight and percentage of dressing of the groups fed either treated or non-treated apple Pomace.

Economic efficiency:

Data presented in Table 7 showed that, the lowest total feed cost / rabbit (6.58LE) was observed with rabbits fed the diets contained 100% BTPV treated by *Lacto.* followed by those fed 100% BTPV treated by *lacto. + Tricho.* 6.81LE). Results given also, indicated that groups fed 50% or 100% BTPV treated by *lactobacillus* were achieved the highest economic efficiency (180.7, 186.8%) and relative economic efficiency (140.6, 145.4 %) followed in a decreasing order by groups fed 50% or 100% BTPV treated by *lacto. +Tricho.* and least was the control group. It can be noticed that rabbit fed on 50 or 100% biologically treated potato vines (BTPV) by *lacto.* had the best economic return over other treated one.

Table 6. Effect of biologically treated potato vines on carcass characteristics of New Zealand White rabbits.

Items	Control	BTPV(%) Tricho.Vir.		BTPV(%) Lacto.Acid.		BTPV(%) Lacto.Acid.+Tricho.Vi	
		50	100	50	100	50	100
Live body weight (Pre slaughter) (g)	1885.3	1955.3	1907.3	1967.2	1951.3	1962.5	1902
Empty carcass wt(g)	1010[b] ±16.1	1074.6[a] ±6.95	1031[b] ±5.47	1086.6[a] ±6.11	1071.6[a] ±8.08	1081.1[a] ±4.81	1025.6[b] ±6.17
Empty carcass (%)	53.5[b] ±0.34	54.9[a] ±0.32	54.00[b] ±0.18	55.2[a] ±0.05	54.9[a] ±0.32	55.00[a] ±0.12.	53.9[b] ±0.28
Head (g)	118.6 ±4.40	130.5 ±3.46	123.5 ±5.77	132.6 ±5.73	129.0 ±4.61	131.2 ±4.56	121.2 ±3.46
Liver (g)	52.5 ±2.89	56.2 ±1.15	53.9 ±2.57	57.8 ±1.73	55.9 ±1.32	57.2 ±0.46	53.2 ±0.57
Kidney(g)	14.2 ±1.44	16.0 ±0.46	15.2 ±0.57	16.7 ±0.56	15.7 ±2.30	16.4 ±2.88	14.9 ±0.57
Heart (g)	7.20 ±0.75	8.42 ±1.15	8.12 ±1.16	8.77 ±2.30	8.40 ±0.57	8.65 ±2.30	7.95 ±1.73
Giblets(g)	73.9[b] ±3.16	80.62[ab] ±0.59	77.2[ab] ±1.2	83.2[a] ±0.5	80.0[ab] ±1.0	82.2[a] ±0.5	76.05[ab] ±1.42
Giblets %	3.92 ±0.19	4.12 ±0.11	4.04 ±0.06	4.22 ±0.44	4.09 ±0.11	4.18 ±0.04	3.99 ±0.06
Dressing %	59.9[c] ±0.65	61.6[ab] ±0.42	60.5[abc] ±0.45	61.9[a] ±0.42	61.6[ab] ±0.44	61.6[ab] ±0.44	60.1[bc] ±0.51

a,b,c— Means in the same row with different superscripts are significantly different ($P<0.05$).

CONCLUSION

All promising biological and economical results as well as no symptoms of digestive or metabolic upsets or toxic effect of glycoalkaloids (anti-nutritional factors) obtained in this current study, of feeding growing rabbits on potato vines treated by *Trichoderma virdi, lactobacillus* and *lactobacillus acidophilus +Trichoderma virdi* could promote us to announce that these microorganisms were helped effectively in improving the nutritive value of potato vines and reduced its glycoalkaloids content to satisfactory level that helped in:1- avoiding its toxic and anti-nutritional effects. 2- altered its non useful level to useful one. Further more, the preliminary findings reported herein to, indicate that, it appears to be technically feasible the partial replacement of wheat bran with treated potato vines in pelted diets for growing rabbit and the costs were considerably less for the potato vines diets as compared to control.

Table 7: Effect of biologically treated potato vines on economic efficiency of New Zealand White rabbits.

Items	Control (0)	BTPV(%) Tricho. Vir. 50	BTPV(%) Tricho. Vir. 100	BTPV(%) Lacto. Acid. 50	BTPV(%) Lacto. Acid. 100	BTPV(%) Lacto. Acid+Tricho. Vir. 50	BTPV(%) Lacto. Acid+Tricho. Vir. 100
Average weight gain(kg)	1.104	1.197	1.472	1.217	1.187	1.202	1.141
Selling price*/rabbit(LE) (A)	17.6	19.1	18.3	19.4	18.9	19.23	18.25
Total feed consumption/ rabbit (kg)	5.034	4.839	4.918	4.801	4.880	4.852	4.900
Price/kg feed (LE))	1.53	1.48	1.43	1.44	1.35	1.46	1.39
Total feed cost/rabbit(LE) (B)	7.70	7.16	7.03	6.91	6.59	7.08	6.81
Net revenue(1)	9.90	11.94	11.27	12.49	12.31	12.15	11.44
Economic efficiency%(2)	128.5	166.8	160.3	180.7	186.8	171.6	167.9
Relative economic efficiency(3)	100	129.8	124.7	140.6	145.4	133.5	130.6

Market price/Kg body weights 16 LE.

(1) Net revenue = A-B

(2) Economic efficiency =(A-B / B) x100

Where: A is the selling price of the obtained gain, B is the feeding cost of this gain.

(3) Relative Economic Efficiency = Economic efficiency of treatments other than the control / Economic efficiency of the control group.

Acknowledgements

It is a pleasure to thank those who made this work possible. We would like to thank Dr. A. M. Gomaa Professor of Agricultural Microbiology, National Research Centre for helping us in biological treatments and Dr. A. A. Mahrous Senior Researcher of Animal Nutrition, Animal Production Research Institute, Agricultural Research Center, Egypt,for his supporting.

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الأداء الإنتاجي للأرانب النيوزيلاندي المغذاة على عروش البطاطس المعاملة بيولوجيا

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أجريت هذه التجربة لدراسة أمكانية التخلص من المواد المثبطة (الجليكوسيدات) بواسطة المعاملات البيولوجية وإحلال هذا المخلف المعامل بيولوجيا محل النخالة بنسب ٥٠ - ١٠٠% و معرفة أثره على النمو ومعاملات هضم المركبات الغذائية وصفات الذبيحة وكذلك الكفاءة الاقتصادية للأرانب النامية .تم استخدام عدد ٦٣ أرنب عمر ٦ أسابيع بمتوسط وزن يتراوح بين ٧٥٠ إلى ٧٨٠ جراما وزعت عشوائيا على سبع مجموعات بكل مجموعة ٩ أرانب مقسمة إلى ٣ مكررات بكل مكرر ٣ أرانب وقد أشارت النتائج إلي زيادة تحلل الجليكوسيدات عند تحضين بكتريا الأكتوباسيلس اسيدوفيليس + فطر التريكوديرما فيردى على عروش البطاطس عند ٣٠ درجة مئوية لمدة ٢١ يوما. أعطت المجموعات المغذاة على٥٠% عروش البطاطس المعامل بيولوجيا (بفطر التريكوديرما فيردى ، بكتريا الأكتوباسيلس اسيدوفيليس و بكتريا الأكتوباسيلس اسيدوفيليس + فطر التريكوديرما فيردى) أو ١٠٠% عروش البطاطس المعامل بيولوجيا ببكتريا الأكتوباسيلس اسيدوفيليس أفضل النتائج من حيث الوزن النهائي ومتوسط الزيادة اليومية في الوزن وكفاءة التحويل الغذائي ومعاملات الهضم والقيمة الغذائية وأفضل وزن و نسبة تصافي للذبيحة عند عمر ١٤ أسبوع مقارنة بالكنترول وباقي المجاميع الأخرى. أدي تغذية الأرانب علي علائق تحتوى على ٥٠% و ١٠٠%عروش البطاطس المعامل بيولوجيا ببكتريا الأكتوباسيلس أعلى كفاءة اقتصادية مقارنة بمجموعة الكنترول وباقي المجاميع الأخرى و أشارت النتائج إلي إمكانية استبدال عروش البطاطس المعامل بيولوجيا في علائق الأرانب النامية بنسب ٥٠ و ١٠٠% بدلا من نخالة القمح وتخفيض تكلفة التغذية بدون أي تأثيرات ضارة.