IMPROVING OF NUTRITIVE VALUE OF WATERMELON VINES AND REDUCING THE PESTICIDES RESIDUES AND ANTINUTRITIONAL FACTOFS BY BIOLOGICAL TREATMENTS AND ITS EFFECT ON PRODUCTIVE PERFORMANCE OF GROWING LAMBS

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Abstract This experiment was conducted to study the effect of using biological treatment by (*Trichoderma reesi*), to reducepesticides residues and antinutritional factors content in watermelon vines and improvement their nutritive value and the feasibility of using biological treated vegetable residues (watermelon vines) in animal nutrition and their effects on productive performance of growing sheep. Fifty male Barki lambs at 6 to 8 months of age with an average live body weight 24.49 ±0.2 Kg were assigned to five groups according to live body weight (10 lambs for each).They were assigned at random to the five experimental rations. The control group was fed 50% concentrate feed mixture (CFM) plus 50% berseem hay (BH) on dry DM basis (R1),other four groups R2, R3, R4 and R5 were fed diet containing 25 and 50 % WMV untreated and treated with *Trichoderma reesei*.The animals were fed the five respective rations twice a day at approximately 7:00 am and 02:.00 pm, while BH and WMV offered at 9:00 am and 4:00 pm. The results showed that degradation of antinutritional factors was more efficient when WMV hay biologically treated with fungi (*Trichoderma reesi*)**.** The values of **antinutritional factors** of the watermelon vines and they reduced as follows total phénols by 54.73%, total, Tannins 71.38%, Saponins 63.67%, Alkaloids44.02% **and** Flavonoids 16.98%compared with untreated vines. Fordry matter intake, digestion coefficients, feeding values and nitrogen utilization of experimental rations fed to sheep. R1 (50% CFM + 50% BH) as control ration and R4 {50% CFM + 25% BH+25% WMV treated with fungi *(Trichoderma reesi*)} had higher ($P<0.05$) DM intake than those fed R2

{50% CFM + 25% BH+25% WMVH (untreated WMV)} and R5 {50% CFM + 50% WMV treated with fungi (Trichoderma reesi)}. R3{50% CFM + 50% WMVH (untreated WMV)} had the lowest value. Animal fed R4 showed more soluble, degradable, less undegradable fractions and more effective degradability. The final body weight (FBW), total body weight gain (TBWG) and average daily gain (ADG) of lambs fed R1 (50% CFM + 50% BH) as control ration recorded the highest values and those fed R4 (50% CFM + 25% BH+25% WMV treated with fungi) which were significantly (P<0.05) higher than the other experimental groups but with slightly increased in the final body weight value for R1 than R4. The best feed conversion (FC), (the lowest values) as g DMI/g gain was recorded with group fed R1 followed by R4 which were significantly (P<0.05) better than R2 and R5.The values of feed conversion being 6.93 and 7.05 for R1 & R4 and 8.22 & 8.73 for R2 and R5 respectively. The worst value was recorded with R3 (10.21). Average feed cost decreased by 14.95 and 31.99 for R2& R3 (rations which contained 25 or 50% untreated watermelon vines) and 13.83& 29.97 for R4 and R5 (rations which contained 25 or 50% watermelon vines treated with fungi) respectively, compared with control one(R1). The economic efficiency improved by 28.22 and 17.93% for R4 and R5 respectively, compared with control group(R1).The results indicated the feasibility of introducing biologically treated watermelon vines with fungi in growing sheep nutrition to reduce fed costs without harmful effects on their performance.

Keywords *Biological treatment, watermelon vines**,** growth performance, digestibility, degradability, nutritive value, antinutritionalfactors and growing lambs.*

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Introduction

Livestock production is one of the important factors in most developing countries especially Arab countries, which could play an important role in the economically of these countries. Feed is the most important cost item for livestock production, which represent about 70% of production cost.Including local by–products into ruminant diets could reduce feed *cost* (Borhami and Yacout, 2001).

Various formulations for animal feed have been developed, but the cost of production of feeds has been major threat to animal production Use of cheaper and lesser-known and conventional feed supplement may represent the low-cost route to improve animal performance (Pin Xu et al., 1992). Oloyo and Ilelaboye (2001)evaluated that the nutritive quality of byproducts of some crops and concluded that are potentially good sources of dietary energy and protein supplement for ruminants. There are still many by-products available in Egypt, not used as feed for animals due to lack of information on their nutritional values and yet economic return if using them. Most of crop residues are disposing by burning it causing environmental pollution and health hazard. One of by–products is watermelon vine**.**Bassiouni (2001) reported that watermelon vine hay (WMVH) had higher nutritive value, dry matter and protein degradability, as well as, it was better utilized than both wheat straw and rice straw by ruminants. Saleh *et al*. (2003) reported that the lactating buffaloes fed rations contain 25 and 45% of watermelon vine hay (WMVH) had better economic efficiency than control one.The seeds and vines cropscontain some antinutritional factors as total phenols, Saponin,total tannins, nitrite and nitrate Ilelaboye and Pikudea (2009)& Amal Fayed (2012).

Polyphenolic compound like tannins are known to interfere with digestion and absorption in animals (Eggum *et al*., 1983; Back Knudsen *et al*., 1988). They form complexes, not only with dietary protein in foods (Singh and Eggum, 1984). (Cheeke, 1983) he showed that Saponin is a group of substances that occur in plant and can produce soapy lather with water.The saponin in a forage crop has been shown to affect palatability and intake of nutrient. Ilelaboye and Pikudea (2009) reported thatthe natural toxicants aseptically the saponin content of the crop residues are too high and will present a potential health hazard to the animal. In order to improve the nutrient quality potential of the crops byproducts further study should be done on effect of processing on the nutrient composition of the crops byproducts.Khorshed, (2000) mentioned that biological treatments using some fungi were tested to improve the nutritive value and digestibility of poor quality roughages. El-Ashry *et al*., (2003) showed that enzymatic hydrolysis by fungi and biological conversion of cellulosic materials improve the nutritive value of residues especially crude protein and crude fiber. Gowda *et al*., (2007) showed that biological treatments are essential for improving the nutritive value of such by-products and they were used to reduced anti- nutritional factors by using certain fungi. Biological treatment with fungi (*Trichoderma reesi*) is reported to be highly effective in reducing the level anti- nutritional factorsAmal Fayed *et al*., (2012).She indicated that anti nutritional factors as the glycoalkaloids content of potato vines as affected by biological treatment by fungi (*Trichoderma reesi*), were reduced from 218,34 mg/100g to be 75.22 mg/100g dry vines.Khattab *et al*. 2011, 2013; Alsersy *et al*. 2015; Elghandour *et al*. 2015; Liu *et al*., 2015; Salem *et al*. 2015) they reported that biological treatment of poor quality roughages usually result in marked increases in their CP content digestibility. The increase of CP in treated materials may be due to the presence of microorganisms.Akinfemi and Ogunwole 2012, Khattab *et al*., 2013 and Kholif *et al*., 2014. They showed thatthe capture of access nitrogen by aerobic fermentation by fungus and the proliferation of fungi during degradation.

This study was carried out to evaluate:

1- The possibility of reducing pesticides residues andantinutritional factors in some vegetable crop residues (watermelon vine) by using biological treatments.
2- The possibility of introduced of watermelon vine in diet of growing lambs at two ratio 25 or 50% either as dried or biological treated with fungi (*Trichoderma reesi)* and examines its impact ondigestibility coefficients, degradability,productive performance of growing lambs and its economic efficiency.

Materials and Methods

The present study was carried out at Noubria Experimental Station, Byproduct Utilization Department, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt. This study aimed to evaluate possibility of replacing berseem hay with watermelon vine by-products biologically treated with fungi (*Trichoderma reesi*) or after being dried (sun-dry treatment) on digestibility coefficients, degradability, productive performance of growing lambs and its economic efficiency. The watermelon vine (WMV) was collected from Noubria area, Egypt; after harvesting, chopped (1 to3 cm in length) and left to sundry for a period of 7-10 days reaching a moisture content of 10-12%.The collected watermelon vine was used to be fed hay treated with fungi (*Trichoderma reesi*). Fifty maleBarki lambs at 6 to 8 months of age with an average live body weight 24.49 ±0.2 Kg were assigned to five groups according to live body weight (10 lambs for each).They were assigned at random to the five experimental rations.The control group was fed 50% concentrate feed mixture (CFM) plus 50% berseem hay (BH) on dry DM basis (R1),other four groups R2, R3, R4 and R5 were fed diet containing 25 and 50 % WMV untreated and treated with *Trichoderma reesei*.Chemical analysis and cell wall constituents of untreated, treated WMV with fungus and berseem hay were presented in Table no. 1 and the concentration of pesticides residues of watermelon vine in Table no. 2

Table no. 1 Chemical analysis and cell wall constituents of berseem hay, untreated and treated WMV with fungi (% of DM basis)

Item	BH	WMVH	WMVF
DM	88.12	87.86	86.51
OM	92.67	91.45	89.08
CP	12.76	8.63	14.57
CF	24.81	28.62	24.66
EE	1.62	1.36	1.02
NFE	53.48	52.84	48.83
Ash	7.33	8.55	10.92
NDF	56.26	63.39	59.57
ADF	37.82	47.86	45.06
ADL	8.16	11.87	9.98
Hemi-cellulose	18.44	15.53	14.51
Cellulose	29.66	35.99	35.08

BH: Berseem Hay

WMVH: Water melon vine hay (untreated water melon vine).

WMVF: Water melon vine treated with fungi.

Table no. 2 Concentration of pesticides residues of watermelon vine.

Item	WMVH	WMVF
Permethin (mg/kg)	0.86	0.17
Malathion (mg/kg)	0.69	0.14
Acetamiprid (mg/kg)	0.36	0.06
HCB (mg/kg)	0.16	0.02
Lindine (mg/kg)	0.23	0.06
PP DDE (mg/kg)	0.11	0.01

WMVH: Water melon vine hay (untreated water melon vine).

WMVF: Water melon vine treated with fungi.

The animals were fed the five respective rations in two meals /day. CFM fed as an energy supplement during the experiment. It was offered twice a day at approximately 8:00 am and 3:.00 pm, while BH and WMV offered at 9:00 am and 4:00 pm. The feed allowances calculated according to NRC (2001). The CFM used in this experiment consisted of (%) 20 Yellow corn,19 Soybean meal, 26 Wheat bran, 25 Barely, 6 Molasses,2 Limestone, 1.5 Salt and 0.5Mineral premix. Its chemical compositions (%, on DM base) was 89.36,93.46, 15.75, 6.68, 2.96, 68.07, 6.54, 36.85, 19.55,6.57,17.30 and 12.98 for DM,OM, CP, CF, EE, NFE, Ash, NDF, ADF, ADL, Hemi cellulose and cellulose respectively.

The lambs were weight biweekly in the morning before feeding, through six months as fattening period. Fresh water was available all time.At the end of experimental period, for digestibility trials three adult male Barki sheep for each groupwere housed in metabolic crates for each treatment. Sheep were kept on rations for a preliminary period of 21 days followed by 7 days for total feces and urine collection. Sub samples (20%) of feces and urine were taken once daily then stored at 18 ˚C until analysis. Fecal sample were dried at 60˚C for 72 hrs. Feed and fecal samples were ground through cheese cloth 1 mm screen on a Wiley mill grinder and a sample (50 gm/sample/treatment/ sheep) was taken for analysis.

Samples of feed and feces were analyzed for crude protein (CP), crude fiber (CF), ether extract (EE) and ash, while the urine samples were analyzed to determine its content of nitrogen (N) according to AOAC (2005). Cell wall constituents were determined for neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) using Tecator Fibretic System according to VanSoest *et al.* (1991). Hemicellulose and cellulose were calculated by differences. Values of the total digestible nutrients (TDN) were calculated according to the classic formula of Maynard *et al.* (1979) on a dry matter basis (DM).

Nylon bags technique was used to determine degradability of DM, OM, CP and CFfor each of the roughageswere evaluated using the three fistulated ewes. Two bags (6 cm×12 cm and 53 µm pore size) were used for each incubation time, approximately containing 5g of ground samples of eachroughage were incubated in the ventral part of the rumen and were removed after 3,6,12, 24,48 and 72 h . After removal from the rumen. They were washed in cold water with gentle squeezing until the water become clear. Zero time disappearance values obtained by washing unincubated bags in similar fashion (Ash, 1990). Bags were dried in oven at 60˚C for 48h.and DM loss was recorded for each time. Nitrogen content was also determined.

In Situ degradation data for DM,OM, CP and CF were fitted to the equation of Ørskov and McDonald (1979): $P = a + b\ (1^{-e\text{-}ct})$ where p is degradation rate at time t, a is the intercept representing the soluble fraction of DM,OM,CP or CF (time 0),b is the protein of DM,OM, CP and CF potentially degraded in the rumen, c is therate constant of degradation of fraction b. The ruminally underrated U= 100-(a+ b). The effective degradability (ED) for tested for roughages was estimated from the equation of Ørskov and McDonald (1979) as follow: ED=a + bc/(c+k) where, k is the outflow rate assumed to be 0.03/h under the feeding condition in the current study.

Statistical analyses

Data of growth were statistically analyzed according to Snedecor and Cochran (1980) using SAS (1999).The difference between means was tested by Duncan' s Multiple Range Test (Duncan, 1955). The used model was as follows: $Y_{ij}+ \mu+T_i+e_{ij}$

Where:

Y_{ij}= The obsvation on the 1^{th} treatment.

μ= Overall mean.

T_i= Effect of the1^{th} treatment.

e_{ij} = experimental error.

Results and Discussion:

Table no. 3 showed that the biological treatment with *Trichoderma reesi* reduced the values of **antinutritional factors** of watermelon vines.WalaaAttia (2011) obtained the similar resultsand Amal Fayed *et al*., (2012).She indicated that anti nutritional factors as the glycoalkaloids content of potatovines as affected by biological treatment by fungi (*Trichoderma reesi*), were reduced from 218.34 to be 75.22 mg/100g dry vines.

Table no. 3 Concentration of antinutrional factors of watermelon vine.

Item	WMVH	WMVF
Total phénols (mg/100g)	4.66	2.17
Total tannins (mg/100g)	2.97	0.85
Saponins (mg/100g)	2.78	1.01
Alkaloids (mg/100g)	38.85	21.75
Flavonoids (mg/100g)	1.06	0.88

WMVH: Water melon vine hay (untreated water melon vine).
WMVF: Water melon vine treated with fungi.

Digestibility coefficients

Dry matter intake, digestion coefficients and feeding values and nitrogen utilization of experimental rations fed to sheep were illustrated in Table (4). R1 and R4 had higher (P<0.05) DM intake than those fed R2and R5. R3had the lowest value, this may be due to the effect of pesticides and antinutritional factors in vines. This agreed with Hassan *et al.,* (2010) which obtained the similar result.The same trend was showed for apparent digestion coefficients whereas R1 and R4 recoded higher (P<0.05) values for DM, OM, CP, EE and NFE than the other experimental rations.Hassan *et al.,* (2010) reported that rations contain tomato haulms hay treated with fungi (*Trichoderma reesi*) recorded higher values apparent digestion coefficients for DM, OM, CP, EE and NEF than those fed ration contained untreated haulms.R1 had higher values of digestion coefficients of CF, NDF, ADF and ADL followed by R4 than those fed R2, R3 and R5. Nsereko*et al*., (2002) and Hassan *et al*.,(2010) they showed that the improvement in fiber fraction digestibility as a result of biological treatment may be due to the effect of cellulose enzyme of fungi, which may be responsible for the stepwise hydrolysis of cellulose to glucose. The lower (P<0.05) values of nutritive values (TDN and DCP) was recorded by R2,R3 and R5 than R1 and R4 were related to the less digestion of cellulose accompanied with of alteration of bacterial population**.** There is no significant difference between R1 and R4 for TDN and DCP.Data of nitrogen balance in R3 was the lowest (P<0.05) value (0.93g) while in R1 and R4were the highest (5.95 and 4.85g respectively) this mean that treatments improved nitrogen balance. This was reflected in better (P<0.05)N- utilization of the rations fed to sheep. Similar results obtained by Hassan *et al*., (2010).

Table no. 4 Feed intake and digestion coefficients of experimental rations fed to growing lambs.

Item	R_1	R_2	R_3	R_4	R_5	SEM	*P Value*
Feed intake, g/h/d:							
CFM	446.8	446.8	446.8	446.8	446.8		
Hay	488.19	195.63	-	270.64	-		
WMV	-	174.54	341.19	210.22	411.50		
Total feed intake	934.99 ^{a}	816.97 ^{b}	787.99 ^{c}	927.66 ^{a}	858.30 ^{b}	8.93	0.004
Digestion coefficients, %							
DM	63.33 ^{a}	57.62^{b}	53.81^{c}	64.02^{a}	58.63^{b}	0.39	0.002
OM	66.33 ^{a}	61.02^{b}	57.57^{c}	66.93^{a}	61.83^{b}	0.34	0.006
CP	65.27^{a}	56.89^{c}	49.20^{d}	65.32^{a}	56.30^{c}	0.45	<0.001
CF	60.67 ^{a}	50.01^{c}	43.75^{d}	57.73^{b}	51.31^{c}	0.61	<0.001
EE	68.78^{a}	64.22 ^{b}	59.24 ^{c}	68.30^{a}	59.26^{b}	0.29	0.016
NFE	68.05 ^{b}	64.88 ^{d}	62.91 ^{e}	70.06 ^{a}	66.13^{c}	0.33	<0.001
NDF	65.50 ^{a}	58.31^{c}	52.97^{e}	61.94^{b}	56.28^{d}	0.47	<0.001
ADF	57.98^{a}	50.28^{c}	43.11^{c}	53.26 ^{b}	47.99^{b}	0.31	0.011
ADL	54. 33^{a}	52.13^{c}	41.87^{e}	53.41^{b}	44.70^{d}	0.51	<0.001
Nutritive values, (%)							
TDN	63.65 ^{a}	58.50^{b}	54.96 ^{c}	63.63^{a}	52.95^{d}	0.31	0.001
DCP	9.25 ^{a}	7.68^{c}	6.23^{d}	9.37^{a}	8.64^{b}	0.05	0.001
Nitrogen utilization, g/day							
NI	21.39^{a}	17.66^{c}	15.97^{d}	19.60 ^{b}	21.24^{a}	0.15	0.001
N urine,	7.97^{b}	6.71^{d}	6.93^{d}	7.55^{c}	8.56^{a}	0.13	0.001
N feces,	7.49^{dc}	7.61^{c}	8.11 ^{b}	7.19^{d}	9.20^{a}	0.09	0.001
NA	13.96^{a}	10.05 ^{d}	7.86 ^{e}	12.41^{b}	11.96^{c}	0.42	<0.001

NB	5.95 [a]	3.32[c]	0.93[d]	4.85[b]	3.27[c]	0.13	0.001
NB/NI	27.99[a]	18.89[c]	5.82[d]	24.77 [b]	16.02[c]	0.96	<0.001
NB/NA	42.89[a]	33.16[b]	11.84[d]	39.11[a]	28.45[c]	1.47	<0.001

[a,,b,c,d and e] *Means within rows with different superscripts are significantly different (P<0.05).*
S.E *(stander error*

R1: *50% CFM + 50% BH as control ration.*

R2: *50% CFM + 25% BH+25% WMVH (untreated WMV)*

R3: *50% CFM + 50% WMVH (untreated WMV)*

R4: *50% CFM + 25% BH+25% WMV treated with fungi (Trichoderma reesi).*

R5: *50% CFM + 50% WMV treated with fungi (Trichoderma reesi).*

Degradation kinetics

Estimates of ruminal degradation constants(a, b and c) fitted with rates of DM, OM, CPand CF disappearance of tested roughages are presented in Table (5).Predicate constants were lower (P<0.05) R3 followed by R2 and R5 compared with R1 and R4 forDM, OM, CPandCFdegradability. However R1 and R4 had more soluble,degradable fraction (a & b),lower undegradable fraction (u) and more effective degradability (ED)than in R2,R3 and R5 rations. The great degradative effect of rumen microorganism helps the animal to tolerate Considerable concentrations of the pesticides and antinutritional factors.Hassan *et al*., (2010)whoreported that rations contain tomato haulms hay treated with fungi (*Trichoderma reesi*) had more soluble and degradable fraction (a and b), lower un degradable fraction (u) and more effective degradability (ED) than in untreated one.

Table no. 5 Degradations kinetics of DM, OM, CP and CF for experimentalwatermelon vine for sheep fed the experimental rations.

Item	R_1	R_2	R_3	R_4	R_5	SEM	*P Value*
				DM			
a %	10.72 [a]	9.25[b]	8.07 [c]	10.21[ab]	9.24[b]	0.36	0.027

b%	72.89^{a}	70.28^{b}	63.84^{c}	71.77^{ab}	70.51^{b}	0.42	0.036
a +b%	83.61^{a}	79.80^{b}	71.91^{c}	81.98$^{a b}$	79.75^{b}	0.68	0.029
c %	0.046^{a}	0.036^{b}	0.031^{b}	0.045^{a}	0.043^{a}	0.002	0.043
U	16.38^{c}	20.20^{b}	28.08^{a}	18.02^{bc}	20.25^{b}	0.83	0.011
ED DM%	54.65^{a}	47.69^{d}	41.99^{e}	53.29^{b}	50.61^{c}	0.20	<0.001
				OM			
a %	13.80^{a}	10.21^{c}	8.94^{d}	12.03^{b}	10.74^{c}	0.16	0.019
b%	71.53^{a}	65.92^{b}	64.93^{c}	66.44^{b}	65.96^{b}	0.29	0.025
a +b%	85.33^{a}	76.13^{c}	73.87^{d}	78.47^{b}	76.703^{c}	0.36	0.033
c %	0.046^{b}	0.051^{a}	0.035^{c}	0.052^{a}	0.052^{a}	0.01	0.013
U	14.66^{d}	22.86^{b}	26.13^{a}	21.53^{c}	23.34^{b}	0.30	0.018
ED OM%	59.66^{a}	52.37^{b}	44.07^{c}	54.21^{b}	52.31^{b}	1.28	0.009
				CP			
a %	9.58^{a}	8.54^{b}	7.02^{c}	9.35^{a}	8.97^{ab}	0.20	0.045
b%	46.41^{a}	43.95^{c}	42.10^{d}	45.71^{b}	44.49^{ab}	0.43	0.012
a +b%	56.15^{a}	52.48^{c}	49.11^{d}	55.06^{b}	52.91^{c}	0.31	0.036
c %	0.044	0.045	0.045	0.045	0.044	0.001	0.744
U	44.02^{c}	47.52^{b}	50.89^{a}	44.94^{c}	47.09^{b}	0.32	0.015
ED CP%	37.28^{a}	34.96^{c}	32.30^{d}	36.58^{b}	35.25^{c}	0.48	0.005
				CF			
a %	6.45^{a}	5.96^{b}	4.58^{c}	6.25^{b}	5.93^{b}	0.13	0.024
b%	45.80^{a}	42.68^{c}	39.01^{e}	44.29^{b}	40.9^{7d}	0.28	0.002
a+b%	52.28^{a}	48.64^{c}	43.59^{e}	50.54^{b}	46.91^{d}	0.25	0.001
c %	0.053^{a}	0.047^{b}	0.053^{a}	0.054^{a}	0.047^{b}	0.001	0.008
U %	47.75^{e}	51.38^{c}	56.41^{a}	49.46^{d}	53.09^{b}	0.31	0.002
ED	35.79^{a}	32.04^{c}	29.68^{e}	34.79^{b}	31.31^{d}	0.14	0.001

CF%

a,, ,c ,d and e *Means within rows with different superscripts are significantly different ($P<0.05$).* S.E *(stander error)*

R1: 50% CFM + 50% BH as control ration.

R2: 50% CFM + 25% BH+25% WMVH (untreated WMV)

R3: 50% CFM + 50% WMVH (untreated WMV)

R4: 50% CFM + 25% BH+25% WMV treated with fungi (Trichoderma reesi).

R5: 50% CFM + 50% WMV treated with fungi (Trichoderma reesi).

Growth performance

Data in Table no. 6showed that the final body weight (FBW), total body weight gain (TBWG) and average daily gain (ADG) of lambs fedR1 recorded the highest values and those fed R4which were significantly ($P<0.05$) higher than the other experimental groups but with slightly increased in the final body weight value for R1 than R4.Allam *et al*. (2006) showed that growing lambs fed on fungally treated roughages recorded the highest daily gain compared with control groups. but this disagreed with El-Banna *et al*. (2010) reported that average daily gain of sheep that were fed on SCB treated with brown rot fungi (*T. reesi*/ F-418) was less than that of sheep fed on the untreated SCB.Amal Fayed *et al*., (2012) reported that FBW, TBWG and ADG for lambs fed ration contained potato vine treated with fungi(*Trichoderma reesi*) was found to be significantly ($P<0.05$) higher than the other experimental groups.There is no significant difference between R2and R5for FBW.R2 recorded slightly increased values thanR5. R3had significantly ($P<0.05$) lowest values. In addition,the average daily feed intake of lambs fed R4 was the highest value followed by R1 which was significantly ($P<0.05$) higher than the other experimental groups.Amal Fayed *et al*., (2012)obtained the similar results with potato vine. R3 fed 100% untreated WMVH recoded lowest values of DMI.Hassan *et al*., (2010)showed that the lower intake of untreated tomato haulms ration may be the effect of pesticides which may alter the bacterial population in the rumen.In the other side,El-Banna *et al*. (2010) reported that total DMI (g) of SCB treated with brown rot fungi (*T. reesi* F-418) was significantly decreased from 1 554 to 1 306 g /h/d compared with the untreated SCB.

Table no. 6 Feed intake and daily gain for lambs fed the experimental rations.

Item	R_1	R_2	R_3	R_4	R_5	SEM	*P Value*
Initial body weight, Kg	24.67	24.32	24.37	24.40	24.67		
Final body weight, Kg	58.04^{a}	50.78^{c}	44.02^{d}	57.76^{b}	50.41^{c}	0.53	0.001
Totalweightgain, Kg	33.37^{a}	26.46^{b}	19.65^{d}	33.36^{a}	25.74^{c}	0.87	0.004
Average daily gain, g/d	198.63^{a}	157.5^{b}	116.94^{d}	198.57^{a}	153.21^{c}	1.32	<0.001
Dry matter intake, g/d:							
CFM	838.62	838.62	838.62	838.62	838.62		
BH	538.18	287.28	-	277.28	-		
WMV	-	169.1	355.28	284.09	498.62		
Total DMI, g/day	1376.80^{b}	1295.00^{d}	1193.90	1399.99	1337.24	0.001	<0.001

[a,,c,d and e] *Means within rows with different superscripts are significantly different (P<0.05).*

S.E *(stander error)*

R1: 50% CFM + 50% BH as control ration.

R2: 50% CFM + 25% BH+25% WMVH (untreated WMV)

R3: 50% CFM + 50% WMVH (untreated WMV)

R4: 50% CFM + 25% BH+25% WMV treated with fungi (Trichoderma reesi).

R5: 50% CFM + 50% WMV treated with fungi (Trichoderma reesi).

Feed conversion and feed economicefficiency

The results of feed conversionandfeed economic efficiency by lambs fed the experimental rations showed in Table (7). The best feed conversion (FC), (the lowest values) as g DMI/g gain was recorded with group fed R1 followed by R4 which were significantly ($P<0.05$) better than R2 and R5.The values of feed conversion being 6.93 andfor7.05 for R1 & R4 and 8.22 & 8.73 for R2 and R5 respectively.El-Marakby (2003), he found that lambs fed wheat straw treated with fungi ration, recorded better feed conversion value than the lambs fed the control (untreated one). El-Banna *et al*. (2010) reported that the feed conversion of the sheep fed on the treated SCB with brown rot fungi (*T. reesi* F-418) was increased compared to the sheep fed on the untreated SCB.The worst value was recorded with R3 (10.21). Average feed cost decreased by 14.95 and31.99for R2& R3 (rations which contained 25 or 50% untreated watermelon vines) and 13.83& 29.97 forR4 and R5 (rations which contained 25 or 50% watermelon vines treated with fungi) respectively, compared with control one. The economic efficiency improved by 28.22 and 17.93% for R4 and R5 respectively,compared with control group. Similar results were obtained bySaleh *et al*., (2003).The increased values of average daily gain (ADG) andaverage daily feed intake of lambs fed R4, these finding were reflect on more feed economic and relative economic efficiency for this group (R4) than the other experimental groups. R5 wascome into the second orders forfeed economic and relative economic efficiency parameters.Amal Fayed *et al*., (2012)showed that the highest values of feed economic and relative economic efficiency were recorded for lambs fed ration contained potato vine treated with fungi *(Trichoderma reesi).*Allam *et al*., (2006) found that animal groups fed biologically treated roughages were more efficient than those fed the untreated roughages. Saleh *et al*., (2003) reported that the lactating buffaloes fed rations contain 25 and 45% of watermelon vine hay (WMVH) had better economic efficiency than control one (100%).

Table no. 7 Feed conversion and feed economic efficiency by lambs fed the experimental rations.

Item	R_1	R_2	R_3	R_4	R_5	SEM	*P Value*
Feed conversion(g DMI/g gain)	6.93 [d]	8.22[b]	10.21[a]	7.05[c]	8.73[b]	0.36	0.001

Average feed cost, LE/h/d	3.47	2.95	2.36	2.99	2.43
Average revenue of daily gain, LE	7.95	6.30	4.68	7.94	6.13
Net feed revenue, LE	4.48	3.35	2.32	4.95	3.7
Economic feed efficiency	129.11	113.56	98.31	165.55	152.26
Relative economic efficiency %	100	87.96	76.14	128.22	117.9

[a,,b,c,d and e] *Means within rows with different superscripts are significantly different (P<0.05).*
S.E *(stander error*

***R1:** 50% CFM + 50% BH as control ration.*

***R2:** 50% CFM + 25% BH+25% WMVH (untreated WMV)*

***R3:** 50% CFM + 50% WMVH (untreated WMV)*

***R4:** 50% CFM + 25% BH+25% WMV treated with fungi (Trichoderma reesi).*

***R5:** 50% CFM + 50% WMV treated with fungi (Trichoderma reesi).*

Conclusion

The biological treatment by the fungus (*Trichoderma reesi*) could reduce antinutrional factors content in watermelon vines and improvement their nutritive value. There wasfeasibility in using biologically treated vegetable residues such as watermelon vines in animal nutrition for good productive performance of growing sheep without any adverse effects and with economical profits.In the end it can help in clean environment.

Refernces

Akinfemi A and Ogunwole O A. (2012). Chemical composition and in vitro digestibility of rice straw treated with *Pleurotus ostreatus, Pleurotus pulmonarius* and *Pleurotus tuberregium*. Slovak Journal of Animal Science, 45, 14–20.

Allam S M, El-Hosseiny H M, Fadel M, El-Banna H M and Refai A R. (2006). Nutrients utilization and growth performance of lambs fed rations containing corn Stover treated chemically and biologically. Journal of Agriculture Science (Mansoura University), 31, 1993–2007.

Alsersy H, Salem A Z M, Borhami B E, Olivares J, Gado H M, Mariezcurrena M D, Yacuot M H, Kholif A E, El-Adawy M, Hernandez S R. (2015). Effect of Mediterranean saltbush (*Atriplex halimus*) ensilaging with two developed enzyme cocktails on feed intake, nutrient digestibility and ruminal fermentation in sheep. Animal Science Journal, 86, 51–58.

Amal, M.A. Fayed ; M.H.M. Yacout; A.A. Mahrous; A.A. Hassan and Afaf H.Zedan (2012). Improving of Nutritive value of potato vines by biological treatments and its effect on small ruminants production performance. . Egyptian Journal of Nutrition and Feeds,vol,15(1): 261-271.

AOAC (2005). Official Methods of Analysis, 19th ed. Association of Official Analytical Chemists, Arlington, VA, USA.

Ash, A.J. (1990). The effect of supplementation with leaves from the leguminous trees *Seshagrandi flora, Albizia chinensis* and *Giliricidia sepium* on the intake and digestibility of guinea grass. Animal feed science and technology. 28:225-232.

Back, K.K.E., I. Munk and B.O. Eggun, (1988). Effect of cooking, pH and polyphenoal on carbohydrate and nutrition quality of sorghum (*Sorghum bicolor* L.) Moench). Br. J. Nutr., 59: 31-47.

Bassiouni, M.I.(2001). Using quick method for evaluation of some traditional and nontraditional Egyptian roughages as feedstuff for ruminants J. Agric., Sci., Mansoura Univ., 26:265.

Borhami, B.E.A. and M.H.M. Yacout, (2001). Is the animal protein essential for better utilization of plant protein in ruminants? Egyptian J. Nutr and Feeds (Special Issue) 4:25

Cheeke, P.R., (1983). Biological Properties and Nutritional Significance of Legume Saponins. In: Leaf Protein Concentrate, Telek, L. and H.O. Graham (Eds.). Autism Research Institute, USA. pp: 369-414.

Duncan, D. B. (1955). Multiple range and multiple F-test. Biometrics, II: 1-42.Sci. Mansoura Univ., 26:265.

Eggum, B.O., I. Monowar, K. Bacj, L.R. Munk and J. Axtell, (1983). Nutritional quality sorghum and sorghum foods from Sudan. J. Cereal Sci., 1: 127-137.

El-Ashry, M.A., A.M. Kholif, M .Fadel , H.A. El- Alamy, H.M. El-Sayed and S.M. Kholif (2003). Effect of biological treatments on chemical composition and vitro and in vitro digestibilities of poor quality roughages. Egyptian J. Nutr and Feeds,6:113-126.

El-Banna H. M, Shalaby A S, Abdul-Aziz G M, Fadel M andGhoneem W A. (2010)Effect of diets containing some biologically treated crop residues on performance ofgrowing sheep. Egyptian Journal of Nutrition and Feeds, 13, 21–36.

Elghandour M M Y, Salem A Z M, Martínez Castañeda J S, Camacho L M, KholifA E and Vázquez Chagoyán J C. (2015). Direct-fed microbes: A tool for improving the Utilizationof low qualityroughages in ruminants. Journal of Integrative Agriculture, 14, 526–533.

El-Marakby K M A.(2003). Biological treatments of poor quality rough and its effecton productive performance of ruminants. MSc thesis, Animal Production Department, Faculty of Agriculture, Zagazig University, Egypt.

Hassan, A. A., Khalel, M. S., Shwerab, A. M., Yacout, M. H., Borhami, B. E. E., and Ibrahim, H. Z. (2010). Microbial degradation of pesticides residues in tomato haulms and their effects on performance of dairy cows. Egyptian Journal of Nutrition and Feeds, 13(3), 485-505.

Ilelaboye, N.O.A and O.O. Pikuda, (2009). Determination of Minerals and Anti-Nutritional Factors of Some Lesser-Known Crop Seeds. Pakistan Journal of Nutrition, 8: 1652-1656.

Khattab H M, Gado H M, Kholif A E, Mansour A M and Kholif A M. (2011). The potential of feeding goats sun dried rumen contents with or without bacterial inoculums as replacement for berseem clover and the effects on milk production and animal health. International Journal of Dairy Science, 6, 267–277.

Khattab H M, Gado H M, Salem A Z M, Camacho L M, El-Sayed M M, Kholif A M, El-Shewy A A, Kholif A E. (2013). Chemical composition and in vitro digestibility of *Pleurotus ostreatus* spent rice straw. Animal Nutrition and Feed Technology, 13, 173–182.

Kholif A E, Khattab H M, El-Shewy A A, Salem A Z M, Kholif A M, El-Sayed M M, Gado H M, Mariezcurrena M D. (2014). Nutrient digestibility, ruminal fermentation activities, serum parameters and milk production and composition of lactating goats fed diets containing rice straw treated with *Pleurotus ostreatus*. Asian-Australasian Journal of Animal Sciences, 27, 357–364.

Khorshed, M.M.A. (2000). Different treatments for improving nutritional quality of some crop residues used ruminant nutrition. Ph.D. Thesis. Fac of agric., Ain-Sham Univ., Egypt.

Liu J J, Liu X P, Ren J W, Zhao H Y, Yuan X F, Wang X F, Salem A Z M and Cui Z J. (2015). The effects of fermentation and adsorption using lactic acid bacteria culture broth on the feed quality of rice straw. Journal of Integrative Agriculture, 14, 503–513.

Gowda, N.K.S., R.U. Suganthi, V. Malathi and A. Raghavendra (2007). Efficiency of heat treatment and sun drying of aflatoxin contaminated feed for reducing the harmful biological effects in sheep. Animal Feed Sci., Tech., 133:167-175.

Maynard. L.A.; U.K. Loosli; H.F. Hintz and R.C. Warner (1979). Animal Nutrition (7th. Ed) Megraw. Hill Book Co., New York.

Nsereko,V.L.; D.P. Morgavi; A.F. Furtado ;A.D. Iwause and Y.Wand(2002). Effect of a fibrolytic enzyme preparation from *Trichoderma iongihrachiatum* on the rumen microbial population of dairy cows. Can .J. Microbial, 48:14:21.

N. R.C. (2001). Nutrient requirements of dairy cattle, 7th edition, National Academy Press, Washington DC, USA.

Oloyo, R.A. and N.O.A. Ilelaboye, (2001). Proximate composition of seeds of lesser known crops. Pertanica J. Trop. Agric. Sci., 25: 87-91.

Ørskow, E. R. and I. McDonold (1979). The estimation of protein degradability in the rumen from incubation measurements weighed according to rate passage.J.Agric.,Sci., Cambridge

Pin, X., P. John and J.A. Peter, (1992). Recent advances on methodology for analysis of phytate and inositol phosphate in foods. Prog. Food Nutr. Sci., 16: 245-262.

SAS (2003).SAS User's Guide: Statistics.. SAS Inst., Inc., Cary, NC. Releigh.

Saleh M.S; A.M. Metwally; M .I. Bassiouni and M.A.El-Shora (2003). Utilization of watermelon vine in feeding ruminants II-Effect of replacing berseem hay by watermelon vine hay in feeding lactating buffaloes. Egyptian Journal of Nutrition and Feeds 6(special Issue) 617-626.

Salem A Z M, Alsersy H, Camacho L M, El-Adawy M M, Elghandour M M Y, Kholif A E, Rivero N, Alonso-Fresán M U and Zaragoza A. (2015). Feed intake, nutrient digestibility, nitrogen utilization, and ruminal fermentation activities of sheep fed *Atriplex halimus* treated with three developed enzyme cocktails. Czech Journal of Animal Science, 60, 80–88.

Singh, U. and B.O. Eggum, (1984). Factors affecting the quality of pigeon pea (Cajanus cajan). Qual. Plant Food Hum. Nutr., 34: 273-283.

Snedecor, W. and W. Cochran (1980). Statistical Methods. Iwa State University Press, Ames lwa, seventh edition.

Van Soest, P.J.; J.B.Robertson and B.A.Lewis (1991). Methods for dietary fiber, neutral detergent fiber and non-starch polysaccharides in relation to animal nutritionJ. Dairy Sci., 74: 3583-3597.

Walaa Attia (2011).Performance of New Zealand white rabbits fed onbiologically treated potato vines and eggplant shoot. Ph.D. Thesis. Fac of agric., Cairo - Univ., Egypt.