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Impact of feeding Barki lambs on straw treated with *Trichoderma harzianum* and *Trichoderma viride* on growth performance and protein digestibility

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Abstract

This study was carried out to investigate the impact of feeding Barki lambs on straw treated with *Trichoderma harzianum* and *Trichoderma viride* fungi on growth performance and protein digestibility. Ten male Barki lambs with an average weight of 26 kg were randomly allocated into two groups of five animals each. Lambs in the first group were fed untreated straw (control). While lambs in the second group were fed straw treated with *Trichoderma harzianum* (Th) and *Trichoderma viride* (Tv) fungi (treated group). All experimental animals were fed a concentrated diet and wheat straw at 2 and 1% of their live body weight, respectively, during the feeding trial, which lasted for 90 days. At the end of feeding trial, a digestion trial was carried out on lambs to determine the total digestible nutrients (TDN), digestible crude protein (DCP), and nitrogen balance (NB). The results revealed that treating straw with Th and Tv fungi improved its chemical composition by increasing crude protein and decreasing fiber, and improved the average daily gain, growth rate, TDN, and DCP in male Barki lambs compared to untreated straw.

Keywords: *Trichoderma viride*, *Trichoderma harzianum*, Barki lambs.

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1. Introduction

Agricultural and industrial wastes are considered one of the constant sources of feeding ruminants. One of the determinants of the use of these wastes in feeding ruminants is that these wastes are poor in nutritional such as proteins and vitamins. They also have low digestibility and palatability coefficients and a high content of fiber and lignin (Hassan *et al*., 1998a; 1998b; Hassan *et al*., 1999; Hassan *et al*., 2009). Therefore, the attention of researchers was directed to increase the benefit from it by treating it chemically and biologically, and it has been shown through studies that the use of biological treatment caused rough feed nutritional value improvement in many countries by using fungi and enzymes produced from them that work to break down Cellulosic and lignocellulosic bonds, saving effort and money, and reducing pollution with chemicals (Eun *et al*., 2006; Fazaeli *et al*., 2006; Hassan *et al*., 2008; Rodrigues *et al*., 2008). This study aimed to enhance wheat straw nutritional value by treating it by two types of *Trichoderma viride* and *Trichoderma harzianum* and to study the effect of this on the digestibility coefficient nutrients for lambs fed these treated materials.

2. Materials and methods

2.1 Treating straw with Trichoderma viride and Trichoderma harzianum fungi

The straw was spread on nylon in the fermentation room and sprayed with 76% water, 1% urea, and 2% formaldehyde for 12 hours (Sadq, 2010), then packed into nylon bags and inoculated with *Trichoderma viride* (Tv) and *Trichoderma harzianum* (Th) fungal spores loaded on millet plants according to Dewan (1989) at a ratio of 3 kg/100 kg straw in the inoculation room. Then the inoculated straw bags were incubated at 26±3 °C and 70–75% humidity in the fermentation room for 21 days. After 21 days of incubation, the bags are taken out of the fermentation room, dried in the sun, and stored in nylon bags until the required analysis is carried out and the experimental animals are fed with them. The chemical analysis of the manure and feed were performed according to AOAC (2005).

2.2 Study site, animals, feed, and experimental design

This study was carried out at the research animal production station, Faculty of Agriculture, Al-Azhar University (Assiut branch), Assiut, Egypt. A total of 10 male Barki lambs, having an average body weight of 26 kg, were randomly allocated into two groups of 5 animals each. Lambs in the first group were fed untreated straw (control group), while lambs in the second group were fed straw treated with *Trichoderma viride* and *Trichoderma harzianum* fungi. The experimental lambs were fed a concentrated diet and wheat straw at amounts that represented 2 and 1% of their live body weight, respectively. The feeding trail lasted for 90 days. The average daily body weight gain and growth rate were calculated according to the following equations:

$$Average\ daily\ body\ weight\ gain = \frac{final\ body\ weight\ -\ initial\ body\ weight}{experimental\ period\ (day)}$$

$$Growth\ rate = \frac{final\ body\ weight\ -\ initial\ body\ weight}{initial\ body\ weight} \times 100$$

At the end of the feeding trail, three lambs from each group participated in a two-week digestion trail. After the adaptation period (10 days), the excreted feces and urine from each animal were collected, mixed well, weighed, and a representative sample of 10% of the total weight of the feces and urine was kept in polyethylene bags and bottles at -20°C until the period of collection ended. Each sample from a single animal was mixed and dried, and three samples weighing 20 grams were taken from them to conduct chemical analysis on them. The remaining feed was also collected and weighed for each animal daily to calculate the digestibility coefficient.

2.3 Statistical analysis

The least significant difference was used to test for significant differences between the means after the data were statistically analyzed using SPSS software.

3. Results and discussion

3.1 The chemical analysis of wheat Straw treated with Tv and Th fungi

The results presented in Table (1) showed that treating straw with TV and TH fungi increased crude protein percentage and decreased fiber percentage compared to untreated straw. The improvement in the crude protein content in the treated straw may be due to the degradation of fiber content by cellulolytic enzymes produced from growing fungi (El-Ashry *et al*., 2003). The decrease in crude fiber in the treated straw may be due to the breaking of lignocellulosic bonds, cellulose oxidation, and degradation of lignin by fungi. Our result agreed with the findings of Fayed *et al*. (2009), El-Ashry *et al*. (2009), Abd-Allah (2007), Mahrous *et al*. (2009), and Omer *et al*. (2012).

Table (1): Chemical analysis of concentrate feed mixture and straw treated with *Trichoderma viride* and *Trichoderma harzianum* fungi.

Item	DM%	OM%	CP%	CF%	EE%	Ash%	NFE%
CFM	90.10	93.52	14.11	12.91	2.42	6.48	64.09
WS	89.70	94.80	3.34	36.09	1.60	6.20	44.27
TWS	90.23	94.20	5.20	33.25	1.61	6.80	50.14

CFM: concentrate feed mixture, WS: wheat straw, TWS: wheat straw treated with 1% and *Trichoderma Viride*, *Harzianum Trichoderma* fungi.

3.2 Growth performance of Barki lambs fed wheat straw treated with Trichoderma Viride, Trichoderma harzianum fungi

The results in Table (2) showed that feeding Barki lambs on straw treated with fungus significantly ($p < 0.05$) increased the growth rate and average daily gain compared to the control group. These results are consistent with the findings of EL-Ashry *et al*. (2003) and Omer *et al*. (2012).

Table (2): Impact wheat straw treated with fungi on growth performance of Barki lambs.

Item	Control	TWS	Significance
Initial weight (kg)	26.00	26.00	Ns
Final weight (kg)	37.65	38.80	Ns
Total gain (kg)	11.65	13.80	Ns
Average of daily gain (g)	129.44 ±1.50 [b]	153.33± 3.88 [a]	**
Growth rate %	44.80±1.64[b]	53.08±1.36[a]	**

[a,b] Means in the same row with different superscripts are significantly different ($p < 0.05$), Ns= nonsignificant ($P>0.05$) , **= significant ($P <0.001$), TWS= group of lambs fed wheat straw treated with fungi.

3.3 Impact of treating straw with fungi on digested protein

Lambs fed straw treated with fungus exhibited significant effect ($p<0.05$) on the digestibility and crude protein average as this group outperformed in comparison with the control group (Table 3). The increase in protein intake and digestibility may be attributed to the crude protein higher content of fungus mixed feed because of breaking the bonds that bind protein with lignin and others (Saleh *et al*., 1998; Yamakawa *et al*., 1992). Moreover, our results agree with the findings of Okab *et al*. (2012), Mahrous *et al*. (2009), Omer *et al*. (2012), and Salman *et al*. (2010).

3.4. Effect of treating straw with fungi on nutrient values

The results in Table (3) showed that the group fed with straw treated was significantly superior in total digestible nutrients to the control group. On the other hand, there was no significant difference in nitrogen balance (NB) between the control and treated group. these data agree with the data described with Yamakawa *et al*. (1992). The enhancement of the digested nutrients percentage in treated group due to the enzyme produced by the fungi in digesting cellulose, which converts it into easily digestible glucose (Nsereko *et al*., 2000). On the other hand, Mahrous *et al*. (2009), and Omer *et al*. (2012), believe that the total nutritional and total digestible elements increase results from improved digestion of cell wall components compared to untreated feed, and that the group fed on feed treated with fungi tend to outperform the group fed on untreated feed in total digested nutrients and digested protein compared to the control one.

Table (3): The effect of treating straw with fungi on the nutritional value.

Item	Control	TWS	Significance
TDN %	69.31[b] ±1.570	72.30[a]± 2.759	*
DCP %	5.11[b]±0.980	6.19 [a]±0.490	*
NB	3.87±0.115	3.90 ±0.100	Ns

[a,b] Means in the same row with different superscripts are significantly different ($p < 0.05$), Ns= nonsignificant ($P>0.05$) , *= significant ($P <0.05$), TWS= group of lambs fed wheat straw treated with fungi, TDN= total digestible nutrients, DCP= digested crude protein, NB= nitrogen balance.

4. Conclusion

From the results of this study, it can be concluded that treating wheat straw with *Trichoderma harzianum* and *Trichoderma viride* fungi improves its chemical composition, average daily gain, growth rate, TDN and DCP in male Burke lambs compared to untreated straw.

References

Abd-Allah, S. A. S. (2007), *Biological treatments of some by- products in ruminants feeding*, M.Sc. Thesis, Animal Production Department, Faculty of Agriculture, Al-Azhar University, Egypt.

AOAC (2005), *Official Methods of Analysis of AOAC International*, 18th ed., Association of Official Analytical Chemists, Rockville, MD, USA.

Dewan, M. M. (1989), *Identity and frequency of occurrence of fungi in roots of wheat and ryegrass and their effect on talk-all of wheat and host growth*, Ph.D. Thesis, University of Western, Australia, pp. 210.

El-Ashry, M. A., Fayed, A. M., Youssef, K. M., Salem, F. A. and Hend, A. A. (2003), "Effect of feeding flavomycin or yeast as feed supplement on lamb performance in Sinai", *Egyptian Journal of Nutrition and Feeds*, Vol. 6, pp. 1009–1022.

El-Ashry, M. A., Kholif, A. M., Fadel, M., El-Alamy, H. A., El-Sayed, H. M., El-Shafie, M. H., Mahrous, A. A. and Abdel-Khalek, T. M. M. (2009), "Effect of biological treatments for wheat straw on performance of small ruminants", *Egyptian Journal of Nutrition and Feeds*, Vol. 10 No. 2, pp. 635–648.

Eun, J. S., Beauchemin, K. A., Hong, S. H., and Bauer, M. W. (2006), "Exogenous enzymes added to untreated or ammoniated rice straw: Effect on in vitro fermentation characteristics and degradability", *Animal Feed Science and Technology*, Vol. 131 No. 1-2, pp. 87–102.

Fayed, A. M., El-Ashry, M. A. and Aziz, H. A. (2009), "Effect of feeding olive tree pruning by-products on sheep performance in Sinai", *World Journal of Agricultural Sciences*, Vol. 5 No. 4, pp. 436–445.

Fazaeli, H., Azizi, A., and Amile, M. (2006), "Nutritive value index of treated wheat straw with Pleurotus fungi fed to sheep", *Pakistan Journal of Biological Sciences*, Vol. 9 No. 13, pp. 2444–2449.

Hassan S. A., Tawffek, J. A. and El-Saady, M. E. (2009), "Effect substitution gradually percentages of reed silage with alfalfa straw fed with probiotic to Awassi lamb.1- On daily feed intake, live weight gain and feed conversion ratio", *The Iraqi Journal of Agricultural Science*, Vol. 40 No. 1, pp. 158–173.

Hassan, S. A., Al-Sultan, A. A. A. and

Ahamed, A. A. (1999), "Effect of using different nitrogen sources and molasses on intake of ground dried reed treated and untreated with sodium hydroxide in feeding Awassi lambs", *The Iraqi Journal of Agricultural Science*, Vol. 30 No.1, pp. 433–440.

Hassan, S. A., Al-Samaraae, W. H. and Hashim, A. J. (2008), "Using of microbial treatment to improve nutritive value of ground and chopped barley straw", *The Iraqi Journal of Agricultural Science*, Vol. 38 No. 6, pp. 43–58.

Hassan, S. A., Al-Sultan, A. A. A. and Al-Darraji, A. N. (1998a), "Study of chemical treatment effect by sodium hydroxide or ammonia hydroxide or urea on chemical composition and in vitro digestibility of organic matter in dry matter and pH for dried ground reed", *Dirasat: Agricultural Sciences*, Vol. 25, pp. 273–295.

Hassan, S. A., Al-Sultan, A. A. A. and Al-Darraji, A. N. (1998b), "Effect of substitution gradually percentages of ground dried red treated with ammonia hydroxide with alfalfay in Awassi lambs fattening diets", *Dirasat: Agricultural Sciences*, Vol. 25, pp. 125–134.

Mahrous, A. A, Abdel-Khalek, T. M., El-Shafie, M. H., Sayah, M. and Ghada, I. S. (2009), "Improving the nutritive value of corn stalks by some fungus treated", *Egyptian Journal of Nutrition and Feeds*, Vol. 12 No. 3, pp. 523–533.

Yamakawa, M., Abe, H. and Okamoto M. (1992), "Effect of incubation with edible mushroom, *Pleurotus ostreatus*, on voluntary intake and digestibility of rice straw by sheep", *Nihon Chikusan Gakkaiho*, Vol. 63 No. 2, pp. 129–133.

Nsereko, V. L., Morgavi, D. P., Rode, L. M., Beauchemin, K. A. and Mc Alliater, T. A. (2000), "Effect of fungal enzyme preparation and hydrolysis and subsequent degradation of alfalfa straw fiber by mixed rumen microorganism *in vitro*", *Animal Feed Science and Technology*, Vol. 88 No. 3-4, pp. 153–170.

Okab, A. B., Ayoub, A. M., Samara, M. E., Abdoun, A. K., Al-Haidary, A. A., Korim, A. A. and Hassan, A. A. (2012), "Improvement of growth and nitrogen utilization in sheep using sugar beet pulp treated with *Trichoderma reesseior* urea", *Tropical Animal Health and Production*, Vol. 44, pp. 1623–1629.

Omer, H. A. A., Ali, F. A. F. and Gad, S. M. (2012), "Replacement of clover straw by biologically treated corn stalks in growing sheep rations", *Journal of Agricultural Science*, Vol. 4 No. 2, pp. 257–268.

Rodrigues, M. A. M., Pinto, P., Bezerra, R. M. F., Dias, A. A., Guedes, C. V. M., Gardoso, V. M. G., Cone, G. W., Ferreira, L. M. M., Colaco, J. and Sequeira, C. A. (2008), "Effect of enzyme extracts isolated from white rot fungi on chemical composition

and *in vitro* digestibility of wheat straw", *Animal Feed Science and Technology*, Vol. 141 No. 3-4, pp. 326–338.

Sadq, S. M. (2010), *Comparative feeding value of untreated, urea-ammoniated and fungal treated barley straw in growing karadi lambs*, PhD. Thesis, College of Agriculture, University of Sulaimani, Iraq.

Saleh, A. S., Metwally, A. M. and Mohsen, M. K. (1998), "Effect of feeding spent roughage produced from mushroom cultivation on the performance of goats", *Egyptian Journal of Animal Production*, Vol. 35, pp. 481–492.

Salman, F. M., Salama, R., Khattab, A. E., Soliman, S. M., El Nomeary, Sarnklong, C., Cone, J. W., Pellikaan, W. and Hendriks, W. H. (2010), "Utilization of rice straw and different treatments to improve its feed value for Ruminants: A review", *Asian-Australasian Journal of Animal Sciences*, Vol. 23 No.5, pp. 680–692.