Carcass characteristics and meat analysis of rabbits feed fungal treated corn stalks

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INTRODUCTION

In the developing countries, such as Egypt, animals suffer from **shortage** of feeds and, also, are continuously **increasing in the costs**.

However, many million tons of agricultural residues are producing from fields and processing of fruits and vegetables per year.

In Egypt there are about 25 million tons of agricultural by–products produced annually.

Such low quality roughages (corn stalks and rice straw) are **high** in lignocellulytic materials and are generally **low** in readily available carbohydrates as well as nitrogen and certain minerals.

Also their utilization is limited as a reason of **low** voluntary intake by the animals and **high** transportation cost, being bulky.

INTRODUCTION

A great deal of research work was done to **full use** of this by–products and **increasing** their feeding value.

Intake and **utilization** of low quality roughages could be increased by

Supplementation with some nutrients

or

Applying some treatments, such as:

Physical

Chemical

Biological methods

Among these methods, **biological treatments** were shown to be the most effective method.

INTRODUCTION

Previous studies reported that feeding biological treated agricultural by-products did not significant effect on dressing percentage for rabbits (**Morad, 2005** and **Abd El-Hakim *et al.*, 2006**).

While few studies (**El-Badawi *et al.*, 2007**) pointed that feeding rabbits on biological treated sugar beet pulp significant increased dressing percentage.

Results of the previous research stated that chemical composition of rabbit's meat was affected by feeding biological treated rice straw and sugar beet pulp (**Morad, 2005**, **Abd El-Hakim *et al.*, 2006** and **El-Badawi *et al.*, 2007**).

OBJECTIVE

This work aimed to study effect of replacing clover hay by fungal treated corn stalks with *Trichoderma ressei* on carcass characteristics and meat composition of rabbits.

MATERIALS AND METHODS

Microorganisms and fungal treatment for corn stalks

Three days old slants cultures of *Trichoderma ressei* was crushed into flasks containing 20 ml of sterilized water.

The fungi spores suspension was used as inoculant at 10 % V/W to inoculate 500 ml capacity flasks containing 25 g of ground corn stalks moistened at solid: liquid ratio of 1:2 with basal medium composed (g/L); 40 sugarcane molasses, 2 urea, 0.2 potassium di-hydrogen phosphate and 0.3 magnesium sulfate.

The inoculated flasks were incubated at 30^{o} C for 3 days. under static solid-state fermentation.

Fungal treatment for corn stalks

The prepared inoculate was used to inoculate 500 g of moistened stalks by the above basal medium at solid: liquid (1:2) at 10 % V/W and packed in polyethylene bags.

The inoculated bags were incubated at room temperature (30 ± 2 °C) for 10 days.

Fungal treatment for corn stalks

160 kg of chopped corn stalks was equally divided into two heaps.

The first heap was moistened with medium contained; 2.5% molasses, 2.5% urea, 1.5% ammonium sulphate, 1.00% supper phosphate and 0.5% magnesium sulphate at solid: liquid (1:2) mixed well and spread on plastic sheet without *Trichoderma reesei*.

The second heap was moistened with the above medium and inoculated with the previous prepared *T. reesei* inoculant at 10%, mixed well and spread on plastic sheet.

The two heaps were shuffled upside down daily for 14 day (the proper treatment period).

Fungal treatment for corn stalks

At the end of treatment period, the treated stalks was collected and exposed to sun- dry until the moisture content reached less than 10%.

The dried stalks packed and stored until used in manufacturing the pelleted diets.

Table 1. Chemical analysis (%) of raw, untreated (without *T. reesei*) and fungal treated corn stalks with *T. reesei*

Item	Corn stalks		
	Raw	Without *T. reesei*	With *T. reesei*
DM	93.00	91.50	91.80
OM	88.50	87.01	84.69
CP	5.61	**13.99**	**16.68**
CF	37.78	**32.96**	**24.13**
EE	1.11	**1.32**	**1.56**
NFE	44.00	38.74	42.32
Ash	11.50	**12.99**	**15.31**

Table 2. Cell wall constituents (%) of raw, untreated (without *T. reesei*) and fungal treated corn stalks with *T. reesei*

Item	Corn stalks		
	Raw	Without *T. reesei*	With *T. reesei*
NDF	72.50	65.85	60.00
ADF	56.00	47.75	45.25
ADL	15.56	16.95	18.75
Hemicellulose	16.50	18.10	**14.75**
Cellulose	40.44	**30.80**	**26.50**

Hemicellulose = NDF- ADF.
Cellulose = ADF- ADL.

Experimental diets

The air dried treated corn stalks without and with *Trichoderma reesei* was used to formulate the experimental pelleted diets by replacing of clover hay at the levels of **0, 33, 66 and 100 %** (0, 11, 22 and 33 % of whole diet, respectively.

Seven diets were formulated to be iso-nitrogenous and iso-caloric, and to meet the nutrients requirements of growing rabbits according to recommendation of **NRC (1977)** as show in Table (3).

Table 3. Formulation of the experimental diets

Ingredients	Experimental diets						
	Control	Without *T. ressei*			With *T. ressei*		
	0%	33%	66%	100%	33%	66%	100%
Yellow corn	15.75	31.00	39.35	38.75	31.00	39.35	38.75
Barley	14.46	2.00	1.50	1.50	2.00	1.50	1.50
Soybean meal	17.40	19.65	21.65	21.65	19.65	18.00	17.0
Wheat bran	16.50	11.00	0.60	0.60	11.00	4.25	5.25
Clover hay	33.00	22.00	11.00	-	22.00	11.00	-
Corn stalks	-	11.00	22.00	33.00	11.00	22.00	33.00
Calcium Di-phos.	2.05	2.40	2.85	3.05	2.40	2.85	3.05
Lime stone	0.10	0.20	0.25	0.60	0.20	0.25	0.60
NaCl	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Premix *	0.30	0.30	0.30	0.30	0.30	0.30	0.30
L.Meth.	0.04	0.05	0.10	0.15	0.05	0.10	0.15

Experimental diets

Table 4. Chemical analysis (% on DM basis) and digestible energy (DE, Kcal/Kg feed) of the experimental diets

Component	Experimental diets						
	Control	Without *T. reesei*			With *T. reesei*		
		33%	66%	100%	33%	66%	100%
DM	86.12	91.21	91.10	91.11	91.54	91.43	90.97
OM	89.10	90.14	89.86	88.45	88.98	88.64	87.93
CP	17.03	16.99	17.02	17.09	18.11	16.95	16.57
CF	14.07	13.37	12.56	12.56	11.38	10.36	10.07
EE	2.50	2.56	2.39	2.28	2.57	2.32	2.50
NFE	55.50	57.22	57.89	56.52	56.92	59.01	58.79
Ash	10.90	9.86	10.14	11.55	11.02	11.36	12.07
DE	2513	2503	2495	2412	2518	2501	2425

Experimental diets

Table 5. Cell wall constituents (% on DM basis) of the experimental diets

Component	Experimental diets						
	Control	Without T. reesei			With T. reesei		
		33%	66%	100%	33%	66%	100%
NDF	33.84	30.46	32.12	28.49	37.97	35.24	31.68
ADF	18.17	14.74	17.72	14.73	17.54	15.38	16.90
ADL	12.89	3.84	7.22	2.99	6.52	8.56	5.88
Hemicellulose	15.67	15.72	14.40	13.76	20.43	19.86	14.78
Cellulose	5.28	10.90	10.50	11.74	11.02	6.82	11.02

Hemicellulose = NDF- ADF.

Cellulose = ADF- ADL.

Experimental animals and Feeding trials

A total number of 42 weaned New-Zealand white rabbits, 6 weeks of age and weighted 500 g ±90 g were randomly divided into 7 experimental groups (6 rabbits in each), **each group divided** into three replicates (2 animals each).

The animals were fed on the pervious diets for 13 weeks (91 days).

All animals were kept under the same managerial and hygienic conditions and housed in metal battery cages (2 rabbits each).

Diets and water were offered *ad-libitum*.

Slaughter trials

At the end of experimental period, rabbits were fasted for 12 hr.

Animals were individually weighted before sacrificing.

Three rabbits from each group slaughtered by cutting the neck and jugular vein with a sharp knife to evaluate carcass characteristics and meat composition.

When complete bleeding was achieved, the slaughtered weight was recorded.

Slaughter trials

The skin, viscera, legs, tail, lung, liver, kidneys and heart were removed, then rest of the body was weight to determine the dressing weight.

Carcass cuts (fore part, middle part, hind part and head with neck).

The carcass meat samples from 9, 10 and 11th ribs dried at 60 ºC for 24 hr. and kept for chemical analysis.

Statistical analysis

The collected data were subjected to statistical analysis as two way analysis of variance using the general linear model procedure of **SPSS (1997).**

Duncan's Multiple Range Test was used to separate means when the dietary treatment effect was significant (**Duncan,1955**).

The statistical model was:

$$Y_{ijk} = \mu + Ti + L_j + (TL)_{ij} + e_{ijk}$$

Where;Y_{ijk}: Observation, μ: Overall mean, Ti: Effect of treatment, L_j: Effect of level, TL_{ij}: Interaction effect between the treatments and levels, and e_{ijk}: the experimental error.

RESULTS

Table 6. Effect of feeding fungal treated corn stalks on growth performance of rabbits

Item	Experimental diets							
	Treatments		SE	Levels of corn stalks				SE
	Without *T. reesei*	With *T. reesei*		0%	33%	66%	100%	
Animal No.	24	24	-	12	12	12	12	-
Initial wt., g	571	553	20.7	566	572	568	542	20.7
Final wt., g	2060^{b}	2254^{a}	33.0	2079^{bc}	2361^{a}	2199^{b}	1990^{c}	33.0
Total gain, g	1489^{b}	1701^{a}	26.5	1513^{c}	1789^{a}	1631^{b}	1448^{d}	26.5
ADG, g/h/d	16.36^{b}	**18.69^{a}**	0.3	16.63^{c}	**19.66^{a}**	17.92^{b}	15.91^{d}	0.3

Table 7. Effect of interaction between treatments and replacing levels of corn stalks on growth performance of rabbits

Item	Experimental diets								SE
	Without *T. reesei*				With *T. reesei*				
	0%	33%	66%	100%	0%	33%	66%	100%	
Animal No.	6	6	6	6	6	6	6	6	-
Initial wt.,g	566	568	581	570	566	576	554	514	20.71
Final wt., g	2079^{c}	2207^{bc}	2055^{cd}	1900^{d}	2079^{c}	2515^{a}	2344^{ab}	2080^{c}	32.99
Total gain,g	1513^{d}	1639^{c}	1474^{e}	1330^{f}	1513^{d}	1939^{a}	1790^{b}	1566^{d}	26.51
ADG, g/h/d	16.63^{d}	18.01^{c}	16.19^{e}	14.62^{f}	16.63^{d}	**21.31^{a}**	19.67^{b}	17.21^{d}	0.30

Table 8. Effect of feeding fungal treated corn stalks on dressing percentage of rabbits

Item	Experimental diets							
	Treatments		SE	Levels of corn stalks				SE
	Without *T. reesei*	With *T. reesei*		0%	33%	66%	100%	
Slaughter wt.(SW),g	2321	2505	75.0	2348	2426	2348	2529	75.1
Empty body wt. (EBW),g	2098	2263	67.8	2121	2192	2122	2286	67.8
Carcass wt. (CW_1),g	1262	1353	37.9	1257	1337	1268	1369	37.9
Carcass wt.+ total giblets(CW_2),g	1379	1482	41.6	1357.7	1460	1401	1504	41.6
Dressing percentages (DP), %								
DP1	54.56	54.10	0.5	53.67	55.17	54.09	54.38	0.5
DP2	60.38	59.87	0.6	59.39	61.06	59.87	60.19	0.6
DP3	65.94	65.57	0.6	64.12	66.71	66.16	66.03	0.6

Dp_1= CW 1/ SW DP_2 = CW 2/ EBW DP_3 = CW 2+ total edible offals (giblets/ EBW.

Table 9. Effect of interaction between treatments and replacing levels of corn stalks on dressing percentage of rabbits

Item	Experimental diets								SE
	Without *T. reesei*				With *T. reesei*				
	0%	33%	66%	100%	0%	33%	66%	100%	
Slaughter weight (SW), g	2348	2302	2319	2316	2348	2549	2377	2744	75.1
Empty body wt. (EBW), g	2122	2080	2096	2092	2122	2304	2147	2479	67.8
Carcass wt. (CW_1), g	1257	1279	1222	1290	1257	1394	1313	1448	37.9
Carcass wt.+total giblets (CW_2), g	1357	1400	1344	1415	1357	1521	1459	1592	41.6
Dressing percentages (DP) %									
DP1	53.67	55.63	52.91	56.03	53.67	54.71	55.27	52.73	0.5
DP2	59.39	61.57	58.56	62.01	59.39	60.55	61.18	58.36	0.6
DP3	64.12	67.37	64.37	67.90	64.12	66.05	67.95	64.15	0.6

Dp_1= CW 1/ SW DP_2 = CW 2/ EBW DP_3 = CW 2+ total edible offals (giblets/ EBW.

Table 10. Effect of feeding fungal treated corn stalks on carcass cuts of rabbits

Item	Experimental diets							
	Treatments		SE	Levels of corn stalks				SE
	Without *T. reesei*	With *T. reesei*		0%	33%	66%	100%	
Carcass wt. (CW_1),g	1262	1353	37.9	1257	1337	1268	1369	37.9
Carcass cuts, g								
Fore part	385	416	14.1	383	397	399	424	14.1
Middle part	252	269	8.7	228^{b}	279^{ab}	250^{a}	**285^{a}**	8.7
Hind part	458	499	15.8	477	486	460	490	15.8
Head + Neck	168	168	4.2	168	175	158	169	4.2

Table 11. Effect of interaction between treatments and replacing levels of corn stalks on carcass cuts of rabbits

Item	Experimental diets								SE
	Without *T. reesei*				With *T. reesei*				
	0%	33%	66%	100%	0%	33%	66%	100%	
Carcass wt. (CW_1),g	1257	1279	1222	1290	1257	1394	1313	1448	37.92
Carcass cuts, g									
Fore part	383	387	370	399	383	408	427	448	14.05
Middle part	228	266	243	272	228	291	258	298	8.74
Hind part	477	455	450	448	477	517	470	533	15.78
Head + Neck	168	172	159	171	168	178	159	169	4.24

Table 12. Effect of feeding fungal treated corn stalks on rabbits meat composition

Item	Experimental diets							
	Treatments		SE	Levels of corn stalks				SE
	Without *T. reesei*	With *T. reesei*		0%	33%	66%	100%	
DM	39.31	39.41	0.99	35.92	40.08	40.90	40.54	0.99
CP	61.02	62.02	0.70	61.10	62.20	62.25	60.52	0.70
EE	36.81	35.34	0.67	36.24	35.58	35.60	36.88	0.67
Ash	2.17^{b}	**2.64^{a}**	0.09	2.66^{a}	2.22^{b}	2.15^{b}	2.60^{a}	0.09

Table 13. Effect of interaction between treatments and replacing levels of fungal treated corn stalks on rabbits meat composition

Item	Experimental diets								SE
	Without T. reesei				With T. reesei				
	0%	33%	66%	100%	0%	33%	66%	100%	
DM	35.92	40.31	41.00	40.02	35.92	39.85	40.80	41.06	0.99
CP	61.10^{ab}	62.92^{ab}	58.90^{b}	61.14^{ab}	61.10^{ab}	61.47^{ab}	65.59^{a}	59.90^{ab}	0.70
EE	36.24^{ab}	35.16^{ab}	39.16^{a}	36.68^{ab}	36.24^{ab}	36.01^{ab}	32.04^{b}	37.08^{ab}	0.67
Ash	2.66^{ab}	1.92^{c}	1.94^{c}	2.18^{bc}	2.66^{ab}	2.52^{ab}	2.37^{bc}	**3.02^{a}**	0.09

CONCLUSION

From the previous results could be concluded that it can be replacing clover hay by fungal treated corn stalks in growing rabbits diets.

Thank You
For Your Attention