Research Article

Effect of Dietary Replacement of Barley with Mushroom Cultivation on Carcass Characteristics of Awassi Lambs

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Abstract | This study was conducted to investigate the effect of replacing mushroom cultivation spent (MCS) instead of barley in Awassi lambs ration on some carcass characteristics. Mushroom (*Pleurotus ostreatus*) spent were collected from Agriculture College, Tikrit's university mushroom farm, dried and mixed with rations. Thirty five local Awassi male lambs aged 5.5-6.5 months with initial weight of 30±0.39 kg were allocated to five treatments with seven lambs in each treatment and were distributed to individual cages. The treatment groups were as follows: T1 (control treatment), T2 (5% MCS), T3 (10% MCS), T4 (15% MCS) and T5 (20% MCS). Percentage use of barley was minimized for each treatment ration in order to maintain a fixed percentage of protein (i.e., 14%). Wheat straw was provided *ad libitum* as a roughage diet while concentrate diet was provided @ 3% of live body weight for each treatment for the whole study period which was seventy days. After finishing the study period and before slaughter the lambs, slaughter weight was taken; thereafter other measurements were taken following the slaughter. Results showed significant decrease ($p \leq 0.05$) for T4 and/or T5 groups in each slaughter weight, empty body weight, hot and cold carcass weight, dressing percentage, fat tail percentage, backfat thickness, rib eye area and leg lean percentage, while there was no clear effect for MCS treatments on each forequarter and hindquarter cuttings, carcass and offal fat percentage. It can thus be concluded that it is possible to use mushroom cultivating spent (MCS) instead of barley in the ration of Awassi lambs within 15% without any negative effect on studied carcass characteristics.

Keywords | Mushroom, Awassi lambs, Ration, Carcass, Barley

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INTRODUCTION

Ruminants generally and sheep in particular are considered the main source of red meat in Iraq, and nutrition is one of the factors affecting significantly the production of meat in quantity and quality. The most important aspects that have been studied were to find cheap and available forage alternatives in order to reduce the cost of production or improve meat production or both.

Roughages in different types are important in ruminant's nutrition because of its bulky nature, and ability to benefit the microorganisms present in the rumen. Iraq produces large quantities of hay but because of low nutritional value as a result of high proportion of lignocellulose complexes in hay, the microorganism (such as bacteria, protozoa and fungi) are unable to break down all that complexes effectively (Mahesh and Mohini, 2013). In order to break down lignocellulose complexes and release cellulose to enhance hay's nutritional value in ruminants feed, many methods are being followed such as solid-state fermentation (Kamra and Zadrazil, 1988) and other biological treatments (Villas-Bôas et al., 2002) as well as physical and chemical treatments (Sarnklong et al., 2010).

As a result of mushroom cultivation expansion in the last decades, big quantities of cultivation remnants have been produced. Wheat straw is one of that cultivation media which is used after mixing with poultry waste, calcium and nitrogen sources (Valmaseda et al., 1991; Joshi and Shek-

hawat, 2014). This media must get rid of it after several reaping of mushroom and replace with another new media which leads to accumulation of large amount of that media as a waste which is used as a fertilizer or be burned leading to increased production costs as a result of the accumulation of such waste (Oei, 1991). Fazaeli and Shafeyi (2005) noticed that each crude protein percentage improved and crude fiber percentage go down for the cultivation media spent comparing with raw hay that use to made that media. This difference may be a result of adding nitrogen sources and fungal residues (Bakshi and Langer, 1991) or a result of microorganism enzymes (Ball and Jackson, 1995) which make cultivation media spent one of the good and cheap by product materials that can be used as a proper alternative food in ruminants nutrition.

Thus, the aim of this study was to investigate the ability of using mushroom cultivation spent (MCS) in different levels instead of barley with Awassi lambs ration and its effects on some carcass characteristics.

MATERIALS AND METHODS

Mushroom cultivation spent (MCS) (*Pleurotus ostreatus*) were collected from Agriculture College, Tikrit's university mushroom farm after multi reproductive cycle mushroom reap, then dried under sun rays and crushed with straw crusher. Afterwards a sample was taken for chemical analysis before keeping the whole dried MCS in nylon bags until used in rations.

Thirty five locally Awassi male lambs aged 5.5-6.5 months with initial weight of 30±0.39 kg were allocated to five treatments with seven lambs in each treatment as follows: T1 (control treatment), T2 (5% MCS), T3 (10% MCS), T4 (15% MCS) and T5 (20% MCS). Percentage use of barley was minimized for each treatment rations in order to maintain a fixed percentage of protein i.e., 14% (Table 1). Mixture of salts, vitamins and minerals were added by 1% to each treatment ration without introducing them into the ration formation percentages. All the experimental protocols were approved by the institutional animal care and use committee.

Treatment lambs were distributed to individual cages of 1.75×1.25m, each cage containing two portable plastic feeders for each concentrate and roughage feed, besides portable water pail and mineral salts block. Each lamb was subjected to introductory period for two weeks before the start of study so as to accustom the lambs to the cages and feed providing style. Routine veterinary treatment schedule was followed in this period for all of the lambs. At the end of study period (70 days), weight of each lamb was taken by small ruminant electronic scale, and that was considered as slaughter weight. Afterwards, the other measurements such as hot carcass weight, empty body weight and offal fat weight were taken after the slaughter. Carcasses were covered with cloth and hanged in chilling room (4 degree centigrade for 24 hours) and cold carcass weights were taken. Each kidney and pelvic fat, tail fat and neck weights were recorded before cutting the carcasses lengthwise into two equal halves right and left (Forrest et al, 1975).The weights of each fore quarter and hind quarter cuts were recorded as well as rib eye area and back fat thickness. Leg physical dissection was done (Jones et al, 1983) and weights of components were recorded.

Statistical analysis was conducted to investigate treatments effect on different measurements by statistical analysis program (SAS, 2004) with completely randomized design. The differences between the averages were compared by Duncan polynomial test (Duncan, 1955).

RESULTS

Table 2 shows the effect of different treatments on various weights and dressing percentage. A significant decrease (P≤0.05) for each slaughtering weight, empty body weight, hot and cold carcass weight and dressing percentage was noticed in T4 and T5 groups when compared with

Table 1: Treatments ratios content and percentage of use and replacement

Feed stuff	Crude protein* (CP) %	Control treatment T1		5% MCS treatment T2		10% MCS treatment T3		15% MCS treatment T4		20% MCS treatment T5	
		Use %	CP	Use %	CP	Use %	CP	Use %	CP	Use %	CP
		%		%				%		%	
Crushed barley	11	52	5.72	44	4.84	37	4.07	29	3.19	20	2.21
Crushed yellow corn	9	25	2.25	25	2.25	23	2.07	21	1.89	21	1.89
Soybeans	44	8	3.52	8	3.52	8	3.52	8	3.52	8	3.52
Wheat bran	17	15	2.55	18	3.06	22	3.74	27	4.59	31	5.27
MCS**	5.6	0	0	5	0.28	10	0.56	15	0.84	20	1.12
Total		100	14	100	14	100	14	100	14	100	14

* Based on dry matter; ** Mushroom cultivation spent

Table 2: Effect of different treatments on different weights and dressing percentage (mean±std error)

Treatments	Parameters				
	Slaughtering weight (kg)	Empty body weight (kg)	Hot carcass weight (kg)	Cold carcass weight (kg)	Dressing percentage based on empty body weight (%)
Control T1	45.37 ± 2.00 a	37.22 ± 1.69 a	22.64 ± 1.09 a	22.11 ± 1.06 a	59.44 ± 0.97 a
5% MCS T2	42.0 ± 1.353 ab	34.17 ± 1.34 ab	20.40 ± 0.86 ab	19.93 ± 0.87 a	58.28 ± 0.68 ab
10% MCS T3	42.07 ± 1.43 ab	34.49 ± 1.16 ab	20.59 ± 0.65 ab	20.14± 0.61 a	58.43 ± 0.38 a
15% MCS T4	38.30 ± 0.77 b	31.0 ± 0.73 bc	18.8 ± 0.45 bc	17.37 ± 0.48 b	56.03 ± 0.77 bc
20% MCS T5	39.03 ± 1.58 b	29.78 ± 1.34 c	16.87 ± 0.93 c	16.41 ± 0.92 b	54.78 ± 0.98 c

- Different letters within column refer to significant differences (P≤0.05) between means

Tables 3: Effect of different treatments on the right carcass half fore quarter cuts (mean±std error)

Treatments	Parameters				
	Ribs (%)	Shoulder (%)	Breast (%)	Neck (%)	Fore shank (%)
Control T1	3.30 ± 0.18 bc	9.83 ± 0.42 a	17.30 ± 0.46 b	5.64 ± 0.19 b	2.94 ± 0.12 c
5% MCS T2	2.99 ± 0.26 c	9.42 ± 0.58 ab	20.75 ± 1.22 a	5.59 ± 0.13 b	3.17 ± 0.10 bc
10% MCS T3	4.33 ± 0.26 a	7.85 ± 0.15 c	16.95 ± 0.96 b	5.61 ± 0.13 b	3.34 ± 0.18 abc
15% MCS T4	3.95 ± 0.37 ab	8.29 ± 0.27 bc	18.83 ± 0.80 ab	6031 ± 0.11 a	3.53 ± 0.11 ab
20% MCS T5	4.42 ± 0.16 a	8.48 ± 0.63 abc	17.60 ± 0.23 b	5.97 ± 0.30 ab	3.72 ± 0.15 a

- Different letters within column refer to significant differences (P≤0.05) between means

Tables 4: Effect of different treatments on the right carcass half hind quarter cuts (mean±std error)

Treatments	Parameters		
	Leg (%)	Loin (%)	Flank (%)
Control T1	61.11 ± 1.08 ab	4.36 ± 0.23	1.62 ± 0.11 ab
5% MCS T2	58.28 ± 0.74 bc	4.67 ± 0.40	1.57 ± 0.15 b
10% MCS T3	62.08 ± 0.94 a	4.76 ± 0.25	1.73 ± 0.10 ab
15% MCS T4	58.62 ± 0.32 bc	4.92 ± 0.24	1.74 ± 0.06 ab
20% MCS T5	57.54 ± 1.02 c	4.43 ± 0.31	1.98 ± 0.17 a

- Different letters within column refer to significant differences (P≤0.05) between means.

the control treatment T1, however, there was no effect of MCS treatments for T2 and T3 compared to the control treatment.

Table 3 and 4 shows the effect of different treatments on the right carcass half fore quarter and hind quarter cuts. Multi-directional and irregular significant differences (P≤0.05) between treatments (except loin cut) were observed, but in general there was a superiority of MCS treatments (T4 and T5) than control treatment in most of primary cuts and some secondary cuts.

Table 5 shows the effect of different treatments on carcass and offal fat percentage, back fat thickness and rib eye area. No significant differences (P≤0.05) between treatments in abdominal fat, heart fat and kidney and pelvic fat were recorded, while there was a significant decrease (P≤0.05) in fat tail, back fat thickness and rib eye area for MCS treatments of T4 and T5 compared to the control treatment T1.

Table 6 shows the effect of different treatments on leg physical dissection component percentage. We can notice significant decrease (P≤0.05) for treatment T5 in lean percentage and significant increase (P≤0.05) in fat percentage comparing with control treatment T1.

DISCUSSION

Todays, the main goal of animal nutritionist is to find

Table 5: Effect of different treatments on carcass and offal fat percentage, back fat thickness and rib eye area (mean±std error)

Treatments	Parameters					
	Abdominal fat (%)	Heart fat (%)	Kidney and pelvic fat %)	Fat tail (%)	Back fat thickness (cm)	Rib eye area (cm^2)
Control T1	1.71 ± 0.28	0.27 ± 0.03	1.92 ± 0.15	15.65 ± 0.97 a	2.06 ± 0.12 a	5.99 ± 0.31 a
5% MCS T2	1.78 ± 0.63	0.29 ± 0.02	1.16 ± 0.19	15.12 ± 1.11 ab	1.65 ± 0.10 b	5.07 ± 0.23 b
10% MCS T3	1.23 ± 0.18	0.23 ± 0.03	0.95 ± 0.17	12.53 ± 1.07 b	1.62 ± 0.07 bc	6.59 ± 0.15 a
15% MCS T4	1.00 ± 0.15	0.28 ± 0.04	1.21 ± 0.12	9.72 ± 0.85 c	1.71 ± 0.13 b	4.33 ± 0.13 c
20% MCS T5	0.93 ± 0.20	0.28 ± 0.03	1.55 ± 0.72	9.54 ± 0.45 c	1.32 ± 0.1 c	3.29 ± 0.29 d

- Different letters within column refer to significant differences (P≤0.05) between means.

Table 6: Effect of different treatments on leg physical dissection component percentage (mean±std error)

Treatments	Parameters		
	Lean (%)	Fat (%)	Bone (%)
Control T1	61.11± 1.08 ab	21.67 ± 0.60 bc	17.30 ± 0.40 b
5% MCS T2	58.28 ± 0.73 bc	21.94 ± 0.50 bc	20.75 ± 1.22 a
10% MCS T3	62.08 ± 0.94 a	20.90 ± 0.33 c	16.95 ± 0.96 b
15% MCS T4	58.61 ± 1.31 bc	22.83 ± 0.66 b	18.53 ± 0.80 ab
20% MCS T5	57.54 ± 1.02 c	24.83 ± 0.82 a	17.59 ± 0.23 b

- Different letters within column refer to significant differences (P≤0.05) between means.

cheap sources for animal's nutrition without decreasing production performances. For this purpose, several strategies, particularly the use of by products and waste of human foods for animal nutrition have gathered great interest (Adekunle and Omoh, 2014). Our current study have also demonstrated MCS as a cheap alternative source for lambs diet. Our results are in agreement with the results of Fazaeli and Shafeyi (2005) who noticed decrease in Iranian local lambs final weight with increase in dietary ratio of mushroom cultivation spent ratio percentage. Researchers illustrated the reasons of this decline by the reduction that occur in organic matter percentage and increase in ash percentage in ration with high percentage of MCS which has a negative impact on rumen microorganisms. Fazaeli et al. (2014) reported that the reduction in organic matter percentage and increase in ash percentage in ration with high percentage of MCS may affect the total dry matter intake which in turn affects reproductive characteristics negatively.

Polyphenols and other phytochemicals are known to improve animal health and performance due to their renowned antioxidant properties (Kamboh et al., 2015). A number of studies have acknowledged the beneficial effects of these dietary plant compounds for health and disease managements (Nghonjuyi et al., 2015) with better management practices (Abel et al., 2014). However, some compounds appeared in gut or rumens from degradation of primary compounds have some deleterious effects. Phan and Sabaratnam, (2012) reported that the phenol compounds that result from lignin degradation by fungal enzymes may have negative effects on digestion process. Our present results disagree with the results of Al-Mashhadany (2002) who reported that using mushroom cultivation spent in lambs ratio by 20% and above makes an improvement in carcass characteristics.

CONCLUSION

It can thus be concluded that mushroom cultivating spent (MCS) may be used instead of barley in the ration of Awassi lambs within 15% without any negative effect on most of carcass characteristics.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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AUTHOR'S CONTRIBUTION

Ziyad Aldoori designed the study. All authors associated

to carry out the work.

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