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DIETARY ROUGHAGE SOURCES, LEVELS AND ITS IMPACT ON THE FATTENING PERFORMANCE OF OSSIMI MALE LAMBS AND CARCASS CHARACTERISTICS

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ABSTRACT

Forty Ossimi early weaned male lambs (8 weeks old age and 12.86 kg live body weight) were used in a study for 32 wks to investigate the effect of dietary roughage sources and levels during growing and finishing periods on lambs performance and carcass characteristics. At the beginning of 9th week, animals were randomly assigned into four nutritional treatments (each of 10 animals), while a starter ration 15.87 % DCP and 85.23 % TDN was prepared to serve as a control diet during the 1st period. The experimental study included two feeding periods. In the first period (12 weeks), roughage sources *i.e.* Peanut hulls (PH), sugarcane bagasse (SCB) and ground corn cobs (Ccb) were incorporated at 10 % to substitute 10 % corn grains in the control diet to attain three isonitrogenous and caloric rations (16.65 % DCP & 82.40 % TDN). In the second period, roughage levels were increased to 40% from rations composition to attain (13.21 CP and 64.07 TDN %). Metabolic trials were conducted by the end of each feeding period. By the end of the finishing period, 12 randomly slaughtered animals were dressed to justify carcass traits and meet chemical composition. Results obtained indicated that dietary roughage sources and levels didn't affect significantly lambs growth performance during the two feeding periods. However, lambs raised on both (Ccb) and (SCB) rations showed higher ($p<0.05$) feed conversion ratios, lower ($p<0.05$) feed costs and higher ($p<0.05$) net profit returns by the end of the finishing period. Growth performance during the whole period (32wks), pointed out to insignificant difference among groups. Results of carcass characteristics revealed that dietary roughage sources neither affect significantly hot carcass weight nor edible offal organs, however lambs offered (Ccb) ration showed relatively higher insignificant hot carcass weight in compare with the other tested roughages. Dietary roughage sources didn't have any significant influences on the chemical composition of eye muscle tissues (*longismus dorsi*).

Keywords: Dietary roughage, performance, Ossimi lambs and carcass characteristics.

INTRODUCTION

Inclusion of forages or roughages in high concentrate diets is proper in ruminant rations, since they are necessary to maintain normal rumen fermentation, reduce acidosis, improve intakes, stimulate chewing and may increase rate of passage of concentrates (Stock *et al.*, 1990; Jung and Allen, 1995 and Woodford *et al.*, 1986).

Furthermore, it reduces feeding costs and avail nutritional and economic value (Talha, 2001 & Glanc, 2013). It is evident from the literature that forage or roughage alone cannot supply sufficient energy, especially for high producing animals, therefore concentrate supplementation is always needed for maximizing intake and consequently improving overall performance of ruminant animals (Morita *et al.*, 1996). The ratio between roughage to concentrate (R:C) represents one of the major dietary factors influencing feed intake, which is reflected on rumen digesta kinetics and consequently rumen environment, which is the resultant picture to feed utilization by ruminants (Mehrez *et al.*, 2001). Moreover, utilization of diets by ruminants seems to be markedly affected by ratio and the type of roughage and concentrate which is reflected on animal performance and health (Owens, 1987). Mehrez *et al.*, (2001) and El-Ayek *et al.* (2001), reported that the ratio of 25:75 (R:C) showed to be the best among the different tested ratios, in terms of digestibility, feeding values, N utilization and fermentation in the rumen of sheep. On the other hand, results obtained by Hassan and AL-Sultan, (1995) and Talha, (2001) showed that lamb's performance was positively influenced with ratio of 60:40 and 40:60 (R:C), respectively during growing period, while 20:80 was the best during the finishing period. The main objectives of the present study was to investigate the effect of dietary roughage sources and levels during growing and finishing periods on the performance and carcass characteristics of Ossimi male lambs.

MATERIALS AND METHODS

The present study was carried out in the experimental farm station belongs to the faculty of Agriculture, AL-Azhar University, Nasr city, Cairo, Egypt. The aim of the study was to seek for a low cost diet for fattening Ossimi male lambs, through the incorporation of different sources of roughages being; peanut hulls (PH), sugarcane bagasse (SCB) and ground corn cobs (Ccb), at two different levels, *i.e.* 10 and 40 % of ration composition through two successive growth and fattening periods.

Experimental rations and animals management:

Forty Ossimi early-weaned male lambs (8 weeks old age and 12.86 kg live body weight) were randomly assigned after weaning into four nutritional groups, each of 10 animals to receive one of the experimental rations (Table 1), through two successive periods, from March to October 2012.

At the beginning of the 9th week, each experimental group was assigned to receive the corresponding experimental ration which lasted for 12 weeks during the first period and 20 weeks during the second period. Experimental feedstuffs were thoroughly mixed and pelted in 6 and 14 mm screen according to lambs age and live body weight by each feeding stage. The control ration at the first period (Table 1) was based on yellow corn grains and soybean meal and nil roughages to provide 15.87 % DCP and 85.23 % TDN. Roughage sources at 10% level were incorporated in the control ration to substitute 10% corn grains to attain three isonitrogenous and isocaloric rations (16.65 % DCP & 82.40 % TDN), on the average during the 1st period. In the second period, roughages were increased to attain 40%, of ration composition on DM basis to provide (13.21 CP and 64.07 TDN %). Urea was incorporated during the 2nd feeding period, to minimize daily feed costs. Daily feed allowances were calculated according to NRC recommendations (1985).

Rations were offered *ad lib.*, fresh water was available all the day time and animals were kept in semi-opened pens. Daily weight gain, feed intake and residuals were daily estimated. Feed and economic efficiency values were calculated, based on feed conversion parameters, while current cost price (LE/Ton) for different feed ingredients were ; corn grains (1800), soybean meal (4000), urea (700), wheat bran (1400), molasses (800), (Ccb, ScB, PH, 400 LE/Ton), lime stone (400), sodium chloride (600) and premix (15000 LE/Ton) .

Table (1): Formulation of the experimental rations* during the different feeding periods.

Item	1st period				2nd period			
	T_1 Control	T_2 Ccb	T_3 SCB	T_4 PH	T_1 Control	T_2 Ccb	T_3 SCB	T_4 PH
	%	%	%	%	%	%	%	%
Corn grains	56.5	46.5	46.5	46.5	45.0	45.0	45.0	45.0
Soybean meal	30.0	30.0	30.0	30.0	-	-	-	-
Urea	-	-	-	-	2.0	2.0	2.0	2.0
Wheat bran	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Molasses	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Corn cobs (Ccb)	-	10.0	-	-	13.33	40.0	-	-
Sugarcane bagasse (SCB)	-	-	10.0	-	13.33	-	40.0	-
Peanut hulls (PH)	-	-	-	10.0	13.34	-	-	40.0
Costs of food (LE) /Ton**	2416	2276	2276	2276	1181	1181	1181	1181

*** Rations additives include: 2% lime stone, 1% Nacl and 0.5% minerals and vitamins (premix).**

Premix contained per 1 kg. :- Mn 33 mg , Zn 25 mg ., Fe 20 mg , Cu 6 mg ., I 800 mg , Se 66 mg and Co 160 mg .

**** Including cost of feed additives (3 - 3.5 %)**

Digestibility trials:

At the end of each experimental period, metabolic trials were carried out using three lambs per each group. Lambs were put in metabolic cages for 7 days as preliminary period followed by 5 days for collection of feces and urine.

Carcass studies:

By the end of the 2nd feeding period, 3 fasted animals (40 weeks old) from each tested group were randomly chosen and slaughtered. Animals were skinned, evacuated and the hot carcass weight was recorded. Subjective assessments of carcass composition and lean tissue contents were carried out and the hindquarters, shoulders with the ribs were separated and weighed. Edible offal organs *i.e.* liver, heart, kidneys with fat, spleen and lungs were also weighed. A section of eye muscle was dissected at the 13th rib and several measurements were recorded. Lean eye muscle samples were taken for further chemical analysis, while relationships given by Darwish (1967) were used in calculations.

The economic costs of production were calculated as (cost of feeding / kg live body weight gain), irrespective of labour and medication, while the net profit in LE was calculated as the difference between feed costs and the current selling market price *i.e.* 32.0 LE/ kg live body. The effect of feeding regimes on carcass traits and its chemical composition was figured out. Proximate analysis of the experimental rations, lean tissues, urine and feces were conducted according to AOAC (2000) methods.

Statistical analysis:

Data were analysed using the General linear Models procedures of SAS (2004). Differences between means were tested for significancy using the L.S.D test, according to Duncan (1955). Two-way analysis of variance was adopted using the following equation:

$$Y_{ij} = \mu + T_i + R_J + E_{iJ}$$

where:

Y_{iJ} = the observation of the parameter measured,
μ = overall means
T_i = the effect of dietary treatment,
R_j = the effect of replication
E_{iJ} = the random error term

RESULTS AND DISCUSSION

Chemical analysis of tested rations

Chemical composition of different tested rations during the first period (Table 2) showed that, although the control ration showed lower DM, CF and ash contents, but higher OM, CP, EE and NFE percentage. Roughage rations (2-4), indicated nearly similar DM, OM, CP, EE and ash contents. However, (Ccb) ration showed lower CF (7.53 %), but higher NFE (65.35 %) and higher ash contents (4.4 %) in compare with both of (SCB) and (PH) rations, which indicated relatively higher CF *i.e.* 9.24 and 10.96 %, lower NFE (63.95 & 61.65 %), respectively, but similar ash contents. Rations of the second period were characterized by lower NFE (59.3 %) and CP contents (13.21 %) in compare with the chemical composition of the corresponding rations during the first period. on the average to maintain higher biological value of protein, but higher CF and NFE contents. The experimental rations during the second period were characterized by inclusion of urea at 2% level as a complete replacement to natural protein sources and higher roughage sources *i.e.* 40 % to minimize rations feed costs. CP contents of different tested rations was being reduce during the first period to only (13.21 %) during the second period to maintain high biological value of dietary protein.

Table (2): Chemical analysis of tested rations (on DM basis %) during the two feeding periods.

Group		DM %	OM %	CP %	CF %	EE %	NFE %	Ash %
Period 1	1	87.90	96.11	20.61	4.54	3.11	67.94	3.89
	2	90.16	95.60	20.20	7.53	2.52	65.35	4.40
	3	92.34	95.94	19.98	9.24	2.77	63.95	4.06
	4	90.46	95.93	20.49	10.96	2.83	61.65	4.07
Period 2	1	89.64	96.71	13.21	21.64	2.55	59.31	3.29
	2	90.41	95.79	13.12	14.70	2.57	65.40	4.21
	3	90.80	97.17	12.23	21.64	2.43	60.87	2.83
	4	89.93	97.12	14.28	28.49	2.70	51.65	2.88

Digestibility coefficients:

Digestibility coefficients, nutritive values and NB of different tested rations are shown in (Table 3). During the first period, similar DM, OM, CF and EE digestibilities were detected for different experimental rations and without significant differences among tested rations. CP digestibility, showed significant differences among groups, since (Ccb) ration indicated higher ($p<0.05$) CP digestibility and without significancy with (SCB) ration. Peanut hulls ration and the control (nil roughage) showed lower ($p<0.05$) CP digestibilities and without significant difference between them. The control group and (Ccb) ration showed higher ($p<0.05$) NFE digestibility values in compare with both of (SCB) and (PH) rations.

Results of digestion coefficient showed in general, that (Ccb) ration indicated higher digestibility values in most of nutrients, while (PH) ration and to somehow the control showed lower values.

Nutritive value (NV) showed that the control and (Ccb) rations had the best ($p<0.05$) TDN value, while (PH) and (SCB) recorded the lowest ($p<0.05$) TDN and without significant difference between them. Ground corn cobs (Ccb) and (SCB) rations indicated higher ($p<0.05$) DCP content, without significant difference between both, while the control ration showed the lowest value (15.87 %). Digestibility coefficient during the second period, showed higher ($p<0.05$) DM digestibility for (Ccb), (SCB) and the control groups, respectively in comparison with (PH) ration. Higher but insignificant OM digestibility was detected in favor of (Ccb) and (SCB) in compare with the control and (PH) rations. Corn cobs, and (SCB) groups still maintained higher ($p<0.05$) CP, CF and EE digestibility, besides a higher ($p<0.05$) nutritive values in terms of both TDN and DCP content.

Table (3): Digestion coefficients and nitrogen balance of experimental rations during the two experimental periods

Item	1st period					2nd period				
	Treatment				SE	Treatment				SE
	T_1 Control	T_2 Ccb	T_3 SCB	T_4 PH		T_1 Control	T_2 Ccb	T_3 SCB	T_4 PH	
Digestibility Coefficients %										
DM	80.62	81.87	78.59	79.51	±2.0	59.94^{ab}	62.39^{a}	61.33^{a}	55.0^{b}	±1.48
OM	82.59	84.31	81.24	81.55	±2.49	60.41	64.06	65.19	60.05	±1.40
CP	77.0^{c}	84.46^{a}	83.31^{ab}	79.22^{bc}	±1.24	48.33^{b}	65.01^{a}	58.51^{a}	44.94^{b}	±1.34
CF	53.15	60.80	64.01	56.26	±8.42	29.06^{b}	42.48^{a}	36.11^{ab}	23.87^{b}	±2.25
EE	82.30	82.51	85.61	85.60	±1.44	86.30	90.84	87.62	87.95	±1.88
NFE	90.06^{a}	89.54^{a}	85.08^{b}	84.69^{b}	±1.17	75.72^{bc}	71.69^{c}	76.91^{ab}	80.69^{a}	±1.17
Nutritive Values (NV) %										
TDN	85.23^{a}	84.83^{a}	82.30^{ab}	80.06^{b}	±1.93	62.53^{b}	66.91^{a}	66.58^{a}	60.24^{b}	±1.13
DCP	15.87^{b}	17.06^{a}	16.65^{a}	16.23^{ab}	±0.23	6.38^{b}	8.53^{a}	7.16^{a}	6.42^{b}	±0.18
N-balance (g/h/d)										
NI	22.47^{b}	23.97^{a}	21.52^{b}	24.32^{a}	±2.27	28.67^{a}	23.03^{b}	23.87^{b}	26.82^{a}	±1.47
NB	17.30^{b}	20.24^{a}	17.93^{b}	19.26^{a}	±2.01	13.86^{ab}	14.97^{a}	13.97^{a}	12.05^{b}	±1.33

a, b and c different letters indicate significant difference at ($p<0.05$)

Peanut hulls (PH) group showed, in general lower ($p<0.05$) digestibility for most of nutrients with lower ($p<0.05$) nutritive value. According to Hill (2002), peanut hulls may cause severe performance depressions in beef cattle, if it was included at levels higher than 10% of the diet, unless diets contained relatively higher CP (above 15% CP). This matter was evidently detected in the present results, *i.e.* higher (PH) content (40%), with higher CP, but lower available DCP content (14.28 & 6.42 %), respectively

(Tables 2 & 3). Elevation of dietary protein was evaluated as a method for overcoming detrimental performance and digestibility of (PH) rations, (Hill 2002).

As a general evidence, a significant decrease ($p<0.05$) was noticed in nutrients digestibility during the 2nd period, due to the utilization of excessive levels of roughage sources (40%), besides lack of true protein sources. This phenomenon led to suggest that 40% roughage source, adversely affected nutrients digestibility, therefore lower levels must be recommended to maintain an optimum nutrients digestibility.

Nitrogen balance (NB):

Dietary nitrogen utilization during the 1st period (Table 3), showed significant differences among groups in both of NI and retention. However, (Ccb) and (PH) groups showed significantly higher values in both criteria (Hamed *et al.,* 2009), while the control group (lower DCP % ration content), recorded the lowest NB value in this respect (17.30 g/h/d). the higher ($p<0.05$) NI and retention for both the two mentioned groups, might be referred to either higher ($p<0.05$) CP digestibility for (Ccb) or /and due to the higher ($p<0.05$) intake (PH) group. . according to Huston and Shelton (1971); Calhoum (1976), experimental animals tended to consume more significant DMI to compensate either the lower CP content of the ration or its lower CP digestibility. However, all experimental groups indicated positive NB. During the second period, positive ($P<0.05$) NB was detected among groups.

Ground corn cobs and (SCB) groups showed higher ($P<0.05$) NB, but without significant differences between them. Both the two groups retaining higher ($p<0.05$) N than the control and (PH) groups, respectively, irrespective of the higher ($p<0.05$) NI for both the two latter groups. The higher ($p<0.05$) NB for (Ccb) and (SCB) groups in this period, may be related to the higher ($p<0.05$) DCP content of their ration. It was of interest to point out to higher NI during the second period, but lower N retention /h/d in compare with the first period. This matter might be referred to the higher DMI /h/d during the second period (Table 4) with the advance in lambs age and live body weight, but lower N retention due to the lower biological value of dietary protein during such stage.

Growth performance:

Data presented in (Tables 4 and 5) summarized the growth performance of Ossimi male lambs during the two feeding periods and the whole feeding period (32 wks). During the first period there were significant differences ($p<0.05$) among groups in daily DMI, TDNI and DCPI in favor of (Ccb) and (PH) groups, and without significant differences between them. The lower TDNI of (SCB) may be referred to the relatively lower nutritive TDN value of such ration. Besides, both of the control group and (SCB) groups showed significantly lower ($p<0.05$) intake in different terms in comparison with the former two groups and without significancy between them.

Table (4): Mean ±SE of feed intake, body weight gain, feed conversion and economical efficiency for Ossimi male lambs fed experimental rations during the two feeding periods.

Item	1st period					2nd period				
	Treatment				SE	Treatment				SE
	T1 Control	T2 Ccb	T3 SCB	T4 PH		T1 Control	T2 Ccb	T3 SCB	T4 PH	
Mean feed intake g/h/d ±SE										
DMI	681.3^{b}	741.5^{a}	673.2^{b}	741.7^{a}	±9.68	1356.5^{a}	1096.9^{b}	1220.0^{ab}	1173.7^{b}	±33.8
TDNI	580.66^{b}	629.03^{a}	554.07^{c}	593.81^{b}	±10.13	810.2^{a}	741.2^{ab}	791.1^{a}	694.7^{b}	±20.11
DCPI	108.12^{b}	126.51^{a}	112.06^{b}	120.39^{a}	±1.96	86.60^{ab}	93.56^{a}	87.30^{a}	75.32^{b}	±1.81
Av. Body weight gain (kg) ±SE										
Initial B.W.	12.65	13.12	13.05	13.33	±0.53	36.46	38.8	37.05	39.7	±1.4
Final B.W.	36.46	38.8	37.05	39.7	±1.4	47.7	49.0	47.2	47.6	±1.68
Daily gain (g)	170	183	171	188	±10.99	134	121	121	94	±15.43
Feed conversion (FC) Kg DMI/Kg gain ±SE										
FC	4.01	4.04	3.93	3.94	±0.31	10.14^{b}	9.03^{b}	10.10^{b}	12.48^{a}	±2.36
Economic efficiency (LE/kg gain) ±SE										
Feed cost	9.69	9.18	8.91	8.94	±0.25	11.96^{b}	10.66^{b}	11.91^{b}	14.73^{a}	±1.42
Net profit**	22.31	22.82	23.09	23.06	±0.25	20.04^{b}	21.34^{a}	20.09^{b}	17.27^{c}	±1.89

a, b and c different letters in the same row indicate significant difference at ($p<0.05$)

**** Selling market price, 32 LE/Kg live body weight**

Data of body weight gain of different tested rations pointed out to insignificant differences among groups in average daily gain, however (Ccb) and (PH) groups showed insignificantly higher daily gain. Similar results were obtained by Rankins and Gamble (2000). The relatively higher daily body weight gain of both the two groups may be referred to either its higher ration DCP content or higher N retention (Table 3).

Feed conversion values indicated insignificant differences among groups. However, the (SCB) and (PH) groups were more efficient in food utilization, while the control group came in later arrangement after the (Ccb) one. The insignificant superiority of both of (SCB) and (PH) groups during this period may be referred to either lower ($p<0.05$) DMI but higher CP digestibility (SCB) or higher NI and retention (PH) group.

Lambs performance during the second period showed ($p<0.05$) differences among groups in mean daily intake and in different terms. The control and (SCB) groups showed higher ($p<0.05$) DMI and TDNI, while (Ccb) and (PH) groups indicated lower ($p<0.05$) DMI. An improved TDNI intake was seen for (SCB) group, which may be referred to the higher nutritive value of such ration (66.58 % TDN, Table 3).

Significant differences were detected among groups in DCPI, since (Ccb) and (SCB) groups consumed higher ($p<0.05$) amounts of DCPI; the matter which was either referred to lower ($p<0.05$) DMI but with higher nutritive value or higher intake with higher nutritive value, (8.53 and 7.16 DCP %, Table 3). In contrast, the control and (PH) groups showed lower ($p<0.05$) DCPI (86.6 and 75.32 g/h/day), respectively.

The lower ($p<0.05$) DCPI for both the two groups, may be referred to the lower ($p<0.05$) nutritive values (NV) of both rations during the same period. It was suggested that the lower DCP intake in the control group, might have probably forced the experimental animals to increase their DMI to cover their daily DCP requirements, while the relatively lower ($p<0.05$) intake of (PH) ration in compare with their higher ($p<0.05$) intake during the former feeding period, might be related to an adverse effect due to rations palatability, when it was incorporated in sheep ration at higher levels (40%). Similar results were obtained by Hill, (2002). Results obtained in the present study favored the source of roughage as the most effective factor in restricting rations intake. Similar results were reported by EL-Ayek *et al.*, (2001) and Boraie (2003), as roughage source is the more pronounced factor affecting intake.

Growth performance during the second period, indicated, in general insignificant differences among groups in both initial and daily live body weight gain. Average daily gain, ranged between 94.0 – 134.0 g / head. The lower growth performance during the second period as a general phenomenon may indicate that 40 % roughage source adversely affected lambs growth performance, consequently lower roughage percentages must be considered. According to Owens (1987) and Glanc (2013), most finishing diets may generally contain 5 to 15% roughage to reduce the incidence and severity of digestive problems. On the other hand, Traxler *et al.*, (1995), reported that, cattle can be finished on all concentrate diets, however gains and feed efficiencies usually have been improved by including small amounts of roughages.

Lower ($p<0.05$) feed conversion ratio was detected for different experimental groups during the second period. Although, (Ccb) and (SCB) recorded relatively an improved feed utilization in compare with the control group, and without significant differences among them. Peanut hulls (PH) group exhibited the lowest feed efficiency *i.e.* 12.48 kg DMI/kg gain. The lower feed conversion of (PH) group may be referred to roughage source. Higher ascending feed conversion values were obtained by Dark and Fontenot (1966); Kumari *et al.,* (2013), with descending levels of roughage sources incorporated in the finishing diets of crossbred male lambs. Moderate feed conversion ratio was detected for the control group like that in the first period, owing to the positive associative effect of roughage sources included in the control ration. According to Shain et *al.*, (1999), an improved daily gain and feed efficiency were obtained, when different types of forages were added to concentrates.

As a general conclusion (Ccb) group followed by (SCB) and the control group showed significantly lower feed cost and higher net profit/kg gain. On the other hand, (PH) group indicated the lowest ($p<0.05$) feed utilization, the highest ($p<0.05$) feed cost and the lowest net profit value, the matter which might be referred to roughage source (Hill, 2002). However, it was worthy to point out to an expected lower ($p<0.05$) daily gain and lower ($p<0.05$) FC ratio, as a general phenomenon characterized the second feeding period. Such evidence might be mainly related to the excessive inclusion of dietary roughages during such stage; the matter which was relatively reflected on lower ($p<0.05$) rations digestibility and nutritive values (Table 3). Such results might lead to suggest that looking for more economic rations to fatten growing male lambs, might not neglect the actual daily needs of an animal to satisfy animal producers demands.

Results obtained during the growth and finishing period (32 weeks), indicated insignificant differences among groups in DMI /h/d (Table 5). However, (Ccb) group indicated relatively lower DMI, higher final and daily body weight gain, the lowest feed cost and the highest net profit value. Sugarcane bagasse group ranked second in most criteria. Such improved results for both of (Ccb) and (SCB) might be referred to the lower DMI of such groups (Table 5), the higher nutrients ($p<0.05$) digestibility of their rations, besides to the higher nutritive value of such rations during the second period (Table 3), which lasted for 20 weeks. On the other hand, the improved performance of control lambs expressed as growth rate % may be due to the associative influence of roughage sources, as previously reported by Shain *et al.,* (1999); Kumari *et al.,* (2013). Growth performance % expressed as relative growth rate substantiated in general, growth superiority of the control group, in compare with different roughage groups.

Data of feed conversion ratio showed in general, reasonable values during the whole growth and fattening periods, however the same values in relation to the two tested periods, pointed out to lower efficient feed utilization during the second period (Table 4), which ranged between 9.03-12.48 kg DMI/kg gain , the matter which led to suggest that fattening process must to be ceased at relatively, more younger ages and lighter weights *e.g.* 40 kg on the average, to attain higher fattening advantages with almost lower feed costs. It was also noticeable that roughage sources had significant impact on lambs feed intake and efficiency (Table 4), especially at an elder ages, which may point out to the need for some chemical or biological treatments to improve its digestibility and palatability (Salman *et al.,* 2011), before being included in growth and fattening rations, as previously reported by Salama *et al.*, (2011). Using such unconventional roughages in sheep rations suggested that, the most efficient way of adding roughages, is to mix different roughage sources at equal or unequal quantities in order to obtain better feed efficiency (Shain *et al.*, 1999).

Table (5): Mean ±SE of feed intake, body weight gain, feed conversion and economical efficiency for Ossimi male lambs fed different rations during (32 wks) growth and finishing period.

Item	T1 Control	T2 Ccb	T3 SCB	T4 PH	SE
	Mean feed intake g/h/d ±SE				
DMI*	1041.0	970.0	963.6	1006.6	±43.54
TDNI*	747.92[a]	694.61[ab]	715.42[a]	664.56[b]	±31.34
DCPI*	94.67[ab]	105.91[a]	96.58[ab]	92.22[b]	±6.12
	Body weight gain ±SE				
Av.Initial B.W.(Kg)	12.65	13.12	13.05	13.33	±0.53
Av. Final B.W.(Kg)	47.7	49.0	47.2	47.6	±1.68
Total B.W. gain (Kg)	35.1	35.9	34.2	34.3	±1.79
Av. Daily gain (g)	156.5	160.2	152.5	153.0	±7.61
Growth rate (%)	277.1	273.5	261.7	257.1	±21.8
	Feed conversion ±SE				
Kg DMI/Kg gain	6.65[a]	6.05[b]	6.32[ab]	6.58[a]	±0.61
Kg TDNI/Kg gain	4.78[a]	4.34[b]	4.69[a]	4.34[b]	±0.35
g DCPI/kg gain	604.94[b]	661.13[a]	633.34[a]	602.77[b]	±50.97
	Economical efficiency ±SE				
Feed cost/Kg gain (LE)*	10.94	9.65	10.06	10.48	±0.30
Net profit (LE)	21.06	22.35	21.94	21.52	±0.30

*** Based on the relative period of feeding and feed costs (LE/Ton) prevailed during each feeding stage**

Philosophy of incorporating roughages in finishing diets at higher rates to reduce feed costs seemed to be one of the most important limiting factors in finishing business. Data presented in (Table 3), revealed that, as roughage level in the diet increased; most of nutrients digestibilities tended to decrease.

Similar results were reported by Taie, (1998), who found that low fiber diets , had significantly ($p<0.05$) higher digestion coefficients of DM, OM and NFE, while Ahmed (1983) and Santini *et al.*, (1992) reported negative influences of rich fiber diets on DM, OM and NFE digestibilities. It must be taken in consideration, that the most appropriate level of roughage to be rationally included, might be coincide with both of animal age and live body weight. According to different authors (Dark and Fontenote, 1966; EL-Ashry *et al.*, 1976; EL-Serafey *et al.*, 1982; Aly *et al.*, 1982; Mehrez *et al.*, 2001), 25-30% roughage is an appropriate level in finishing diets of male lambs.

Decreasing roughage to concentrate in sheep rations led to improve both daily gain, feed conversion ratio and maximize the net profit value.

From an economic point of view, finishing Ossimi male lambs under such circumstances must be ceased at more younger ages and lighter body weight to maintain more efficient utilization of food at an economic feed costs. Finishing male lambs behind this age and for more heavier weights was shown to result in lower feed conversion, higher feed costs and lower net profit values. Economic efficiency of different tested rations (Tables 5) pointed out to lower feed costs for different roughage groups, ranged between 9.65 LE /kg gain for (Ccb) to 10.48 for (PH) group. The control group recorded the higher feed cost and lower net profit values (LE / kg gain).

As a general conclusion, in fattening animals, emphasis must be placed on maximizing energy intake to produce the most efficient gains, where concentrates must constitute 80 to 90% of the DM in finishing diet (Owens, 1987). On the other hand, most finishing diets may generally, contain 5 to 15% roughages to reduce the incidence and severity of digestive problems (Stock *et al.*, 1987).

Carcass traits:

Results obtained in (Table 6) showed, insignificant differences among groups on either hot carcass weight or edible offal organs, however lambs offered (Ccb) had relatively higher hot carcass weight (24.28 kg), followed by the control group 22.81 kg. Sugarcane bagasse dressed 21.11 kg, while (PH) group dressed the lower hot carcass weight (18.48 kg), respectively. Total edible organs revealed, insignificant differences among groups. The lower TDNI and DCPI for the (PH) group during the second period (Table 4) pointed out to a negative impact on lambs slaughter and hot carcass weight (39.0 and 18.48 kg, respectively), in comparison with the other experimental groups. On the other hand, EL-Ayek *et al.*, (2001) and Loerch and Fluharty (1998), pointed out that, animals fed on high energy diets had greater tendency to fat formation in the tail and most probably brought about through the deposition of excess caloric intake as fat in various fat stores of the body. This matter was obviously true for the control group (Table 4) which showed higher ($p<0.05$) DMI and TDNI (1356.3 gm DMI and 810.2 gm TDNI). On the other hand, roughage sources used had insignificant effects on either the hot carcass weight of slaughtered animals or separable fat (rump and diaphragm), however they were significantly effective for dressing percentages.

Similar results were shown by EL-Ayek *et al.*, (2001), who reported that bean straw (BS) ration was superior on fasting body weight, hot carcass weight and empty body weight than corn stalks (CS) and rice straw (RS), but without significant differences .

The effect of roughage sources on animals dressing percentages pointed out to significant differences among groups (Table 6). Corn cobs ration showed ($p<0.05$) higher dressing percentage (52.40%) compared to the other slaughtered groups; the matter which seemed to be related to the impact of roughage sources and / or to the higher nutrients digestibility and nutritive value of such ration (Table 3). Similar results were reported by Awadalla *et al.*, (1997), and EL-Ayek *et al.*, (2001), who reported that, dressing percentage, pointed out to significant differences among groups due to roughage sources tested . This result however was in contrast with that reported by Singh *et al.*, (2009), who stated that no difference in dressing percentage with rations containing different roughage to concentrate ratios (50:50, 60:40 and 40:60) consisted of maize, bajra or mixture of maize and bajra along with groundnut haulms in kids.

Table (6): Hot carcass weight, edible offal organs, non carcass components%, calculated empty body weight as affected by source roughage.

Items	T1 Contrl	T2 Ccb	T3 SCB	T4 PH	SE
Number of animals	3	3	3	3	–
Slaughter Wt.(Kg)	49.50	46.33	43.66	39.0	±3.18
Full weight of GIT[1] (kg)	9.36	9.26	8.60	8.50	±0.11
Hot carcass Wt.(Kg)[2]	22.81	24.28	21.11	18.48	±1.97
Total edible offals Wt. (kg)	2.03	1.95	1.90	1.84	±0.13
T. E. Offals/H. Carcass %	8.90	8.03	9.0	9.95	±0.55
Hot carcasse+T. E. Offals (kg)	24.84	26.25	23.0	20.32	±2.87
Edible offals (gm)					
Heart	217	233	215	202	±32.78
Liver	710^{a}	583^{c}	643^{b}	537^{c}	±42.2
Kidney	240	233	200	217	±24.87
Lungs	763	825	747	803	±61.28
Spleen	107	80	100	85	±8.85
Rump (kg)	2.73^{a}	1.17^{b}	1.30^{b}	2.03^{ab}	±0.27
Wt. of diaphragm (g)	423	140	220	86.0	±123.5
Total seperable fat (kg)	3.16	1.31	1.52	2.09	±0.38
D. of the eye muscle3	3.56	4.08	4.10	4.33	±0.34
L. of the eye muscle[4]	5.23	5.40	5.33	5.60	±0.21
D. of fat at the m. l. of the m.[5]	0.68^{b}	0.60^{b}	0.53^{b}	1.10^{a}	±0.04
D. of fat at the d. m. of the m.[6]	0.51	0.53	0.46	0.53	±0.03
Dressing Percentage %	46.08^{b}	52.40^{a}	48.35^{b}	47.38^{b}	±0.99
Shape index %	68.06	75.55	76.92	77.32	±5.0
Muscle / Bone ratio	1.57	1.61	1.50	1.34	±0.13
Fat / Bone ratio	0.11^{a}	0.06^{c}	0.07^{bc}	0.09^{ab}	±0.004
Fat / Muscle ratio	0.19^{b}	0.14^{bc}	0.12^{c}	0.25^{a}	±0.01

a, b and c different letters indicate significant difference at (p<0.05)

1- GIT = Gastro intestinal tract

2- Weight of shoulders, wt. of flank, wt. of neck, wt. of fat-tail and wt. of testicles are included.

3- Depth of the eye muscle at the 13th rib (cm) .

4- Length of eye muscle from the median line to the muscle periphery.

5- Depth of fat layer at the median line of the muscle.

6- Depth of fat layer at the distal margin of the muscle.

Results of edible offal organs, (Table 6), showed insignificant differences among groups in different organ's weight, except in liver weight, since the control group had ($p<0.05$) higher average liver weight, in comparison with the other tested roughage groups. This may be probably due to the higher slaughter weight of the lambs. Similar results were reported by

EL-Ayek *et al.*, (2001). Depth and length in cm of *longismus dorsi* (LD) at the 13th rib revealed insignificant differences among the different slaughter groups. The nature of fat deposition, (Table 6) indicated in general, that the (PH) group, had higher (p<0.05) tendency to deposit fat either in separable form in the rump or around the median line of (LD) in compare with different tested roughage. Fat to bone ratio confirmed that the control and (PH) groups, had higher (p<0.05) values without (p<0.05) differences between them.

This result may lead to suggest that (PH) as a roughage source was an effective factor in depositing fat, since (Ccb) and (SCB) had significantly lower values in this respect, which may confirm the positive relationship between (PH) source and nature of fat deposition. The ratio of fat to bone and muscle ratio were higher (p<0.05) for (PH) group as well.

Results of fat deposition exhibited the nature of (PH) roughage source to deposit more fat rather than more lean tissues, the matter which may appeared to be unpreferable in the finishing process. The ratio of muscle to bone revealed insignificant differences among groups, which coincide with the shape index parameter, indicating a constant value. As a general conclusion, lambs which consumed higher (p<0.05) DCPI during the second period *e.g.* 93.56 g/h/day for (Ccb) and 87.3 g/h/day for (SCB) groups, (Table 4), had more tendency to build lean tissue rather than depositing fat. Fat deposition may be correlated to roughage source and TDNI rather than DCPI.

Similar trends were found by Awadalla *et al.*, (1997) and EL-Ayek *et al.*, (2001). According to Taie, (1998), sheep fed high protein diets had more lean and less fat percentage, he added also that lean / fat and lean / bone ratios, followed the same trend.

Chemical composition of the eye muscle, *longismus dorsi* (LD) at the 13th rib:

The effect of different roughage sources on the chemical composition of eye muscle tissues *longismus dorsi* (LD) at the 13th rib showed insignificant differences among groups in DM, CP and EE constituents. However, (SCB) and (PH) groups showed relatively higher DM in compare with the other groups, (Table 7).

Crude protein content showed , higher but insignificant percentages of lean tissues for the control lambs , the matter which might be attributed to the higher DCPI of such group depending on their higher DMI, in spite of the lower DCP content of their diet (6.38 %), (Table 3). On the other hand, (Ccb) group had a comparable value of CP content, (81.81%) in lean tissues which was not significantly different from the control. This may be referred to the higher DCPI (93.56 g/h/day) which was closely related to the higher DCP content of their rations (8.53 % DCP) and the higher (p<0.05) N retention, (Table 3). Comparable significant (p<0.05) results were reported by EL-Ayek *et al.*, (2001) and Taie, (1998). Both investigators attributed the higher CP % in lean tissue to the higher CPI from the diet. According to Sinclair *et al.*, (1991), increasing dietary CP increased carcass protein content.

The lowest CP content in lean tissue for (SCB) group, in spite of their higher (p<0.05) DCPI, (87.3 g/h/day), (Table 4) and the relatively higher DCP content of their ration (7.16 % DCP), (Table 3), seems to be more puzzling and cannot be explained out of the effect of dietary roughage source and its impact on the nature of lean and fat tissue formation.

Results obtained by Searle *et al.,* (1982) pointed out that body composition was not related to energy and protein intake; it was only slightly associated with age and mainly with body weight. This result however was in contrast with that reported by Aly *et al.*, (1982), who stated that DM, CP, EE and energy in lean tissue increased with increasing concentrate level in the rations. The lower EE content in (LD) tissue for the control and (Ccb) groups, (15.50 and 15.69%), respectively confirmed the idea, that pointed out to the effect of type of roughage included on the nature of tissue formation. Comparable values were obtained by AL-Ayek *et al.*, (2001).

Table (7): Chemical composition of the eye muscle, *longismus dorsi* (LD) at the 13th rib on (DM basis %) in Ossimi male lambs as affected by roughage source.

Components	Treatments				SE
	T1 (Control)	T2 (Ccb)	T3 (SCB)	T4 (PH)	
Moisture	67.30	66.51	63.82	61.47	±1.34
Dry matter	32.70	33.49	36.18	38.53	±1.62
Crude Protein	81.50	81.81	75.90	77.10	±2.0
Ether extract	15.50	15.69	21.44	20.35	±2.5
Ash	3.0^{a}	2.50^{b}	2.66^{b}	2.55^{b}	0.09

a & b means with different superscripts indicating significant differences p<0.05 between a & b.

Ash content in lean tissues showed that, control ration (40% mixed roughages) tended to deposit higher ($p<0.05$) ash 3.0%, while other tested roughages pointed out to insignificant differences among them in ash percentage, which ranged between 2.50 to 2.66%. Figures of ash content are lower than those obtained by EL-Ayek *et al.*, (2001) who pointed out to insignificant ash content in lean tissues, due to type of roughages included.

As a general monitoring, it was obviously evident that (Ccb) as a roughage source was the superior tested roughage in compare with (SCB), (PH) and the mixture of both with the control. Incorporation of such type of roughage resulted in higher feed conversion (FC), lower feed cost, higher net profit value (Tables 4 & 5), and higher ($p<0.05$) dressing percentage with the most appropriate CP and EE % content in lean tissue (Table 7).

General conclusion and recommendations:

It could be concluded that, utilization of unconventional resources of roughage, *i.e.* (SCB), (Ccb) and (PH) were acceptable and could be generally incorporated in sheep rations without fear. On the light of carcass study and from an economic point of view, (Ccb) and (SCB) were favored as better roughage resources, since they resulted in higher dressing percentages as a meat production parameter and also higher net profit in LE as live body market weight.

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تأثير مصدر ومستوى مواد العلف الخشنة في العليقة علـى كفـاءة أداء ذكـور حملان الأوسيمى المسمنة وخصائص الذبيحة

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أجريت هذه الدراسة بمزرعة كلية الزراعة جامعة الأزهر بالقاهرة خلال الفترة من مارس - أكتوبر ٢٠١٢ - حيث استخدم في هذه الدراسة ٤٠ حولي ذكر أوسيمى مفطومة مبكرا على عمر ٨ أسابيع وبمتوسط وزن ١٢.٨٦كجم ، قسمت عشوائيا بعد الفطام إلى ٤ مجاميع غذائية (١٠ ذكور/ مجموعة) بهدف دراسة تأثير مصدر ومستوى مواد العلف الخشنة في العليقة على كفاءة أداء ذكور حملان الأوسيمى المسمنة وخصائص الذبيحة والتركيب الكيماوي للحوم. بداية من الأسبوع التاسع من عمر الحملان أستخدم بادئ كعليقة كنترول (١٥.٨٧ DCP % ، ٨٥.٢٣ TDN %). تم استبدال ١٠% من الذرة الصفراء في مجموعة الكنترول بـ١٠% من مصادر مواد علف خشنة مختلفة (قشر فول سوداني، مصاصة قصب، قوالح ذرة) للحصول على ٣ علائق تجريبية متساوية في محتواها من البروتين والطاقة (١٦.٦٥% بروتين مهضوم ٨٢.٤ % مركبات مهضومة كلية والتي استمرت لمدة ١٢ أسبوع بعد الفطام (كمرحلة أولى) . خلال المرحلة الثانية والتي استمرت لمدة ٢٠ أسبوع، تم رفع معدل الاستبدال بالأعلاف الخشنة لتصل إلى٤٠ % من مكونات العليقة، بينما استخدم مخلوط هذه الأعلاف الخشنة بنسبة (١ : ١ : ١) في مجموعة الكنترول، وكانت القيم الغذائية للعلائق المختبرة خلال هذه المرحلة (١٣.٢١% بروتين خام، ٦٤.٧% مركبات مهضومة كلية) وقد تم تكعيب العلائق وتكوينها طبقا لمقررات الـ NRC سنة ١٩٨٥ ، حيث غذيت الحيوانات تغذية حرة مع تجميع البواقي ، كما أجريت بنهاية كل مرحلة تجربة هضم وميزان أزوت. وفى نهاية التجربة الحقلية (٣٢ أسبوع) ذبحت ٣ حيوانات عشوائيا من كل مجموعة لتقييم خصائص الذبائح والتركيب الكيماوي للحومها. ولقد كانت

أهم النتائج المتحصل عليها ما يلى:

١. لم يكن لتأثير مصدر مواد العلف الخشنة المختبرة ولا لنسبة استخدامها أي تأثير معنوي على معدلات نمو الحملان النامية ولا كفاءتها التحويلية وان اختلفت المجاميع معنويا في معدل استهلاكها للعلائق باختلاف مصدر مواد العلف الخشنة المستخدمة، وكانت أفضل المجاميع اداءً خلال المرحلة الأولى (١٢ اسبوع) مجموعة مصاصة القصب.

٢. لم يكن لنوع مادة العلف الخشنة المستخدمة أي تأثيرات معنوية على معدلات النمو خلال المرحلة الثانية والتي استمرت (٢٠ أسبوع) وإن اختلفت معنويا المعدلات اليومية للغذاء المستهلك وكفاءة التحويل الغذائي باختلاف نوع مادة العلف الخشنة المستخدمة - وكانت افضل المجاميع اداءً خلال المرحلة الثانية مجموعتي قوالح الذرة ومصاصة القصب.

٣. أظهرت نتائج كفاءة أداء الحملان على مدار طول فترة التجربة (٣٢ أسبوع) عدم وجود فروق معنوية عموما بين المعاملات تأثرا بمصادر مواد العلف الخشنة المختبرة في جميع القياسات المأخوذة وان رشحت قوالح الذرة كأفضل مصدر مقترح بناء على معدلات النمو وكفاءة التحويل الغذائي واقتصاديات عملية الإنتاج على طول فترة التجربة.

٤. أظهرت الدراسة عدم وجود تأثير معنوي لمصادر العلائق الخشنة المختبرة على وزن الذبائح المتحصل عليها ولا على وزن الأجزاء الحشوية المأكولة وإن كانت مجموعة قوالح الذرة هي الأفضل نسبيا وبدون معنوية مع باقي المجاميع.

٥. كان هناك تأثير معنوي لمصدر الأعلاف الخشنة على النسبة المئوية للتصافى لصالح مجموعة مصاصة القصب (٥٢.٤ %) وكذا على طبيعة الدهن المترسب داخل الذبائح لصالح مجموعة قشر الفول السوداني.

٦. لم يكن لمصدر الأعلاف الخشنة المختبرة تأثير معنوي على التركيب الكيميائي للعناصر الغذائية في اللحوم المتحصل عليها وان كانت عليقة الكنترول ذات تأثير معنوي على زيادة نسبة الرماد في لحومها بالمقارنة بباقي العلائق المختبرة.

الاستنتاج العام والتوصيات:

بناء على النتائج المتحصل عليها فإن استخدام مصادر أعلاف خشنة غير تقليدية (مصاصة القصب ، قوالح الذرة ، قشر الفول السوداني) في علائق الحملان النامية المسمنة يبدوا أمرا مقبولا مما يساعد في توسيع قاعدة مصادر مواد العلف الخشنة المتاحة للحيوانات المجترة ، وتشير الدراسة أيضا بعدم استخدام مواد علف خشنة في علائق الحملان النامية المسمنة بنسب مبالغ فيها (٤٠ %) بغية تقليل تكاليف التغذية وتعظيم أرباح المربين حيث انعكس ذلك سلبا على خفض القيمة الهضمية للأغذية ومعدلات نمو الحملان وكفاءتها التحويلية. وعلى ضوء النتائج المتحصل عليها فقد رشحت قوالح الذرة تلتها مصاصة القصب كأفضل مصادر لمواد العلف الخشنة المستخدمة في عملية التسمين حيث كانت الأفضل اقتصاديا والأكثر ربحية والأفضل في خصائص وصفات الذبيحة.