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EFFECT OF PROTEIN SOURCES ON PERFORMANCE TRAITS, DIGESTIBILITY OF NUTRIENTS, RUMEN ACTIVITY AND BLOOD PARAMETERS OF GROWING LAMBS.

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SUMMARY

Twenty growing baladi male lambs of 35.33 kg average body weight were divided randomly into four treatment groups, five lambs per each for 90 days. The diet of treatment 1 (T1) was composed of 70% concentrate feed mixture, 15% berseem hay and 15 % rice straw. In treatment 2 (T2) 20% of dry matter intake (DMI) was replaced by sunflower meal, treatment 3(T3) 20% of (DMI) was replaced by dried broiler litter (DBL) and treatment 4 (T4) SFM and DBL (1:1) replaced 20% (DMI). Animals were weighed monthly. Digestibility trials were carried out to evaluate the nutritive value of these experimental diets with sheep.

The results showed that daily dry matter intake was significantly higher ($P<0.05$) in T2 and T3 than in T4. The crude protein and crude fiber digestibility values and TDN and DCP intake were higher with SFM and DBL diets than in control diet. The pH values were within the normal range, TVFA, s and NH3-N concentration significantly increased ($P<0.05$) in the tested rations than control diet. Blood plasma chemical analysis showed that total protein, albumin, globulin, AST, ALT, ALP, urea nitrogen and creatinine were not significantly affected by treatments and were within the normal ranges. The average daily gain and feed efficiency of lambs fed T2 (20% SFM) were the highest compared with the other treatments. Moreover, profit above feed cost was improved for the tested rations (T2, T3, T4). It could be concluded that using SFM as replacement of 20 %of DMI for growing lambs resulted in better economic efficiency and lower feed cost to produce one Kg gain.

Key words: *sunflower meal, broiler litter, digestibility, rumen activity, blood parameters, growth performance.*

INTODUCTION

In Egypt, against background of a rapid increasing population that demands animal protein, there is additional need to decrease cost of feed .It has been suggested that farmers make use of non conventional feeds in their animals diets to reduce the need for purchasing of marketable feeds.

Feeding poultry waste to ruminants is well documented in the literature and now practiced worldwide (some of countries, for instance in the whole European Union the use of animal protein sources banned to use for farm animal nutrition, except milk, milk products and in some cases fishmeal).

Poultry waste is good sources of protein and other nutrients for growing sheep. The amount of poultry waste in Egypt produced annually as dry matter is about 0.5-0.8 million metric tons according to the estimated of A.E.S. (1993), having crude protein (CP) of about 160.000 million ton which is equivalent to or more than CP of the main protein sources in the rations of farm animals as cotton seed meal and linseed, (El – Ashry *et al*, 1996) and date

seed and poultry litter, (Salem, 1998), soybean meal and sunflower, (Khattab *et. al.* , 1998) and dried poultry litter (Gabr *et al.*, 2001).

Undecorticated sunflower oil meal (S F M) is one of the under utilized resources. Sunflower green croups have long been used for making silage for ruminants, for seed and scratch feeds (Shehata *et. al.*, 1973; Feed Industry Red Book , 1995). The S F M contains an average of 19.7 % crude protein with a range of 16 – 23.4 %, as reported by ElBaz (1995). Abdelmawla (1997) and Khattab *et al.* (1998) stated that SFM when indicated in ration for fattening stock, it produces a good quality carcass .This may allow proteins to be degraded more slowly or to by pass the rumen to be digested in the lower digestive tract (Mielke and Schingoethe 1981) improving the pattern of amino acids flowing into the small intestine .Thus, two sources of protein, microbial protein which is synthesized in the rumen and dietary protein that escape ruminal degradation, provide amino acids for absorption. Also, Roy *et al.* (1977) indicated separate requirements of nitrogen for rumen bacteria by using ruminal degradable protein .

The objective of this study was to evaluate the influence of protein sources on nutrients digestibility's, rumen activity, blood constituents and growth performance.

MATERIALS AND METHODS

This study was carried out at the Experimental Farm, Animal Production Department, Faculty of Agriculture, Ain Shams University, Cairo, Egypt. Twenty male baladi lambs with an average live body weight of 35.33 kg were divided equally into four treatment groups. The control ration (T1) consisted of 70 % concentrate feed mixture (CFM), 15% berseem hay (BH) and 15 % rice straw (RS). Tested rations were formulated by replacing about 20 % of total dry matter intake by undecorticated sunflower meal (SFM) in tested ration 1 (T2) or dried broiler litter (DBL) in tested ration 2 (T3) or SFM and DBL (1:1) in tested ration 3 (T4).

The chemical composition of experimental CFM, BH, RS, SFM, DBL and experimental rations are presented in Table (1). The animals were fed according to their nutrient Tome (1970). The experimental period lasted approximately 90 days. The animals were weighed every four weeks. At the end of experimental period three animals from each group were used in digestibility trial, including 14 day preliminary period followed by 7 day collection period .At the end of the collection period CFM, BH, RS, SFM, DBL, refused feed and faces samples were analyzed according to A.O.A.C. (1995). Ruminal fluid samples were taken at 4 and 24 hours (hr) post feeding by a stomach tube to determine PH values using an (EIL-7010) combination electrode, ammonia nitrogen (NH3- N) concentration according to Conway (1958) and total volatile fatty acids according to Warner (1964). Blood samples were taken 4 hr. post feeding from jugular vein in test tubes containing sodium EDTA. Blood plasma was separated from blood cells by centrifugation at 4000 rpm. for 20 minutes. Blood plasma was tested for total protein according to Armstrong and Carr (1964) and albumin (Doumas *et al.*, 1971).Globulin was calculated by the difference between total protein and albumin. Determination of plasma urea nitrogen (Patton and Crouch, 1977), creatine (Nealon and Henderson, 1977), creatinine (Husdan, 1968), glutamic-oxaloacetic transaminase (AST) and glutamic- pyruvic transaminase (ALT) (Reitman and Frankel, 1957), cholesterol (Zoppi and Fellini ,1976) and alkaline

phosphatase (ALP) (Ratliff and Hall, 1973) were also determined .

Statistical analysis was performed using least square methods described by Snedecor and Cochran (1982). Significant differences among means were tested between treatments within each duration using Duncan's New Multiple Range Test (1955). The General Linear Models Procedure of SAS (1992) was employed.

RESULTS AND DISCUSSION

Chemical composition, digestibility and nutritive value of feedstuffs and rations:

The chemical analysis revealed that the CP and EE was higher and CF and NFE was lower in DBL compared with SFM (Table1). Similar results were reported by Bhattacharya and Taylor (1975), El-Ashry *et al* .(1987) , Ruffin and McCkay (1990), Abdelmawla (1997) and Abd EL Ghani *et. al.* (1999).

Data in Table (2) dry matter feed intake (DMI) was significantly higher for SFM (T2) or DBL (T3) than for those fed SFM plus DBL (T4). Digested nutrient intakes (TDN and DCP) increased (P< 0.05) by T2, T3 and T4 than those of control diet (T1) especially with T2.These results are in agreement with those obtained by Gabr et al.(1991 a and b 1993 and 2001) and Salem (1992) in similar studies when dried poultry litter was fed at different levels in diets of growing and mature lambs . Similar trend was also recorded by Stern *et .al.* (1994) and Abdelmawla (1997) when they used SFM in ruminant rations.

As for nutrient digestibility and nutritive values of tested rations (Table, 2) , it was clear that inclusion of both (T2) and (T4) caused a slight increase in OM digestibility (P < 0.05) compared to the control (T1) . The addition of SFM significantly (P<0.05) improved digestibility and nutritive values of rations contained 10 or 20 % replacing of total DM. Similar trend has been reported by EL-Ayek and Gabr (1994), Abdelmawla (1997), Salem (1998) and Gabr *et al.* (2001) .

Intake of TDN and DCP was increased (P<0.05) with the different treatments particularly T2.These results agree with those obtained by Salem (1998) and Gabr *et .al.* (1993 and 2001) .Similar results were recorded by Abdelmawla (1997) who added SFM in diets of sheep .The improvement in CP digestibility could be due to an increase in microbial protein synthesis in the rumen caused by more degradable protein in form of NH3-N (Table, 3) being available to rumen microbes (Mehrez ,1981 and Gabr *et al* ., 2001) and / or to the complementary effect undegradable dietary protein and microbial protein (Ørskov, 1982). The increase in CF digestibility of tested rations was about 14.08 ,13.33 and 12.45 % for T2 , T3 and T4 ; respectively , compared to the control. This could be associated with the higher cellulolytic activity in the rumen, ammonia nitrogen utilization and may be explained by the fact that CF and their fractions content of SFM or DBL are efficiently utilized by the microorganisms in the rumen (Muller,1980). Similar trend was obtained by EL- Bedawy *et al.* (1994 a and b). Also, similar results were obtained by Shehata (1973) by using SFM in the ruminant diets.

Rumen activity:

Results presented in Table (3) indicated that ruminal PH increased (P<0.05) only in T2 at 24 hr and T3 at 4hr post feeding, while it decreased (P<0.05) in T3 at 24hr and T2 at 4hr post feeding (P<0.05). Gabr *et al.*, (2001) reported that rumen PH values increased after feeding 4 hr with DBL. Moreover, Abdelmawla (1997) showed that pH values decreased after feeding at 2 hr

Table (1) : Chemical composition of feedstuffs and experimental rations (on DM basis %).

Item	DM	OM	CP	CF	EE	NFE	Ash
Concentrate feed mixture (CFM)*	95.50	93.49	14.5	10.7	2.58	65.71	6.51
Sunflower meal (SFM)	88.30	86.45	11.85	28.9	3.1	42.6	13.55
Dried broiler litter (DBL)	98.85	86.5	17.2	18.1	10.9	40.30	13.5
Berseem hay (BH)	93.70	78.3	15.5	13.45	2.65	46.7	21.7
Rice straw (RS)	98.85	84.10	3.2	33.75	0.35	46.8	15.9
Ration 1 (T1) control	94.73	87.09	11.71	18.95	2.24	54.19	12.91
Ration 2 (T2), 20% SFM	95.56	89.47	11.60	18.78	3.98	55.11	10.53
Ration 3 (T3), 20% DBL	94.53	87.83	12.62	17.85	2.33	55.03	12.17
Ration 4 (T4),10% SFM+10% DBL	95.05	88.65	12.11	17.32	3.16	56.05	11.36

*CFM= Undecorticated cotton seed cake 10, linseed meal 10, yellow corn 25, barley 20, rice bran 11, wheat bran 17, limestone 2, salt 1 and molasses 4%.

Table (2): Digested nutrient intake and digestibility coefficients of sheep fed SFM and DBL.

Items	T1	T2	T3	T4	±SE
No. of animals	3	3	3	3	
Digestibility coefficients, (%)					
DM	72.77ab	75.57a	70.47b	73.5ab	1.29
OM	73.47b	77.80a	74.99b	76.67a	1.45
CP	52.29b	64.69a	60.31a	63.07a	1.36
CF	45.48b	59.56a	58.81a	57.93a	0.73
EE	78.42	80.44	77.15	77.53	1.19
NFE	84.05a	82.32ab	80.51b	82.53ab	1.01
Nutritive value %					
TDN	63.32c	70.32a	66.65b	69.05a	0.71
DCP	5.82b	7.08a	7.17a	7.19a	0.15
Feed intake (g/h)					
DMI	1373.3c	1480a	1423.3b	1401.7b	13.92
Digested nutrient intakes					
TDNI, g	869.3c	1040.1a	948.8b	968.1b	9.20
DCPI, g	79.03c	104.9a	102.2b	100.9b	2.04

a, b and c with different letters on the same row differ at 5 % . T1 Control {CFM+BH+RS(70:15:15 %)}, T2 20% of DMI replaced by SFM. T3 20% of DMI replaced by DBL. T4 20% of DMI replaced by SFMand DBL (1:1).

Table (3) : Ruminal pH, NH_3-N and TVFA's values of the experimental rations.

Items	T1	T2	T3	T4	±SE
4 hour after feeding					
pH value	6.15a	5.68b	6.3a	6.13	0.07
Ammonia nitrogen (mg /100ml)	12.27d	15.13c	19.77a	16.94b	0.32
Total volatile fatty acids (meq /100ml)	9.2b	10.73a	9.4b	9.9ab	0.28
24 hours after feeding					
PH value	6.45b	6.72a	6.18c	6.48b	0.07
NH3-N (mg /100)	10.67c	13.17b	16.47a	14.27b	0.34
TVFA's (meq /100ml)	7.03b	8.27a	7.1b	7.73b	0.18

a, b, c and d Means in the same row with different superscripts differ at (P<0.05).

with SFM. The low PH values for T2 (SFM) group may be due to the production TVFA's. The pH values fell within the normal range for the optimum cellulytic bacterial activity (Mertens, 1977).

Rumen VFA concentrations were affected by T2 ($P<0.05$) or T3andT4 ($P>0.05$) inclusion in the diet as presented in Table (3). Results show that VFA concentrations were higher ($P < 0.05$) in T2 at 4 and 24 hr post feeding compared to the levels of control group (T1).These values are less than those obtained by Salem (1998). He found that increasing TVFA's concentration by feeding DBL.

Ammonia nitrogen concentrations were the highest ($P< 0.05$) in T3 at 4 and 24 hr post feeding. Followed values of ruminal NH3-N concentration in T2, T3 and T4 were significantly higher ($P < 0.05$) than values T1 (control) before and 4 hr post feeding. These findings are in accordance with those of Stern *et al.* (1994), Tamminga (1996) and Abdelmawla (1997) with rations containing SFM Gabr *et al.* (2001) found similar trend using DBL in the ruminant rations.

Blood parameters:

Data of Table (4) showed that total protein, albumin (A), globulin (G), A:G ratio, urea nitrogen, creatinine , AST and ALT were not significantly different ($P > 0.05$) among treatments. Values were in the normal range as determined by Caswell *et al.* (1978), Salem (1992 and 1998), EL-Ashry *et al.* (1998), Abd EL Ghani *et al.* (1999) and Gabr *et al.* (2001). Values indicated that the animals were generally in a good nutritional status and their livers were in normal physiological condition. Normal globulin values indicated good immunity status of animals. Creatine concentration was significantly ($P< 0.05$) lower in T2 and was higher in T3 compared to the control treatment. Cholesterol value was significantly higher ($P < 0.05$) in T2 and lower in T3 compared with values of T1 and T4. Values were in accordance with Khattab *et al.*.(1995), Abdelmawla (1997) and Salem (1998).The data of alkaline phosphatase (ALP) concentration indicated that T2 (SFM) was significantly higher ($P < 0.05$) than T3 (DBL). These results agree with results reported by Khattab *et al.* (1998), Abdelmawla (1997) and Salem (1998).

Growth performance of lambs and economical evaluation:

Average daily gain (Table, 5) was significantly ($P<0.05$) higher in T2 group as compared to the other groups and this was evident in the first and the third month of treatment. The present results agree with EL-Ashry *et al.* (2003) found that the SFM group had higher weight gain than the other protein sources groups. Average daily gain was not significantly different in T3 and T4 with that of control (T1). The same trend was observed by Harvey *et al.* (1990), Abdelmawla (1997), Salem (1998) and Abd El-Ghani, *et al.* (1999).

Data of feed efficiency (g DM / g gain) showed that T2 was significantly more efficient than other groups (T3 and T4), but not significantly different with control. The profit above feeding cost was higher with protein sources supplemented rations than the control group. The superiority of T2 than the other groups may reflect the obtained results of digestibility, nutritive values and rumen activity of this ration.

In conclusion, inclusion of SFM or DBL in the rations as dry matter replacer is more suitable for growing lambs, which improved growth performance such as feed intake, digestibility, daily body gain and decreased feed cost for meat production.

Table (4): Blood plasma metabolites of sheep fed the experimental ration.

Items	T1	T2	T3	T4	±SE
Total protein (g/100ml)	7.5a	6.95ab	6.78b	6.9ab	0.21
Albumin (g/100ml)	3.6	3.3	3.1	3.13	0.16
Globulin (g/100ml)	3.8	3.67	3.67	3.77	0.14
A/G ratio	0.95	0.9	0.85	0.83	0.07
Urea nitrogen (mg/100ml)	15.27	14.07	13.8	13.96	0.45
Creatine (mg/100)	38.23b	35.27c	42.63a	38.37b	0.85
Creatinine (mg/100ml)	126	1.14	1.27	1.2	0.06
Cholesterol (mg/100ml)	75.37b	84.3a	67.63c	77.47b	1.73
Alk -phosphtase (IU/L)	29.63ab	31.43a	28.53b	29.7ab	0.54
GOT(IU/L)	55.37a	58.5a	58.3a	56.23ab	0.69
GPT(IU/L)	20.6	22.5	22.84	22.13	0.78

a,b and c values different letters on the same row differ at 5 % .

Table (5) : Average daily gain and economical efficiency of lambs fed different experimental rations.

Items	T1	T2	T3	T4	±SE
No. of animals	5	5	5	5	
Initial body weight (Kg)	36.17	35.67	34.63	34.83	0.73
Final body weight (Kg)	48.55ab	49.72a	46.62b	46.96b	0.71
Total gain (Kg)	12.38b	14.05a	11.99b	12.13b	0.43
Average daily gain (ADG)	137.7b	153.1a	133.3b	134.8b	2.57
ADG at 1st month, (g/h)	137.67	158.67	143	145	6.69
ADG at 2nd month, (g/h)	122.2	132	126.3	125	6.69
ADG at 3ed month, (g/h)	153ab	168.7b	130.7b	134.3b	9.15
Feed intake (g/Kg0.75)					
DMI	82.73	88.62	88.46	86.69	10.93
TDN	52.37c	62.28a	58.97b	59.87b	0.8
DCP	4.76c	6.28a	6.35b	6.24b	0.11
DMI g/Kg (body weight)	32.45b	34.8a	35.07a	34.29a	0.53
Feed utilization efficiency					
DMI/ADG(g)	9.97b	9.67b	10.68a	10.4b	
TDNI/ADG (g)	6.31b	6.79b	7.12a	7.18a	
DCPI/ADG (g)	0.58b	0.69a	0.77a	0.78a	
Economical evaluation:					
Price of DMI (head/d)*, P.T.	73.68	75.37	67.66	68.98	
Price of gain yield (head/d)**, P.T.[1]	165.24	183.72	159.96	161.76	
Feed cost/gain yield, P.T.	0.446	0.410	0.423	0.426	
Profit above feeding cost/d, P.T .[2]	91.56	108.35	92.30	92.78	

a, b andc : Means with different letters in the same row are significantly (P<0.05) differed.

1- Adjusted gain yield / head / day x selling price of one Kg (12 L.E.).

2- Price of gain yield / head/d; P.T.- Feeding cost /head/d , P.T.

***The calculation of the values was based upon the prevailing prices of each Kg of the ingredients being for CFM, BH, RS, SFM and DPL was 67,40, 5, 40 and 23.1 P.T., respectively .**

****The average selling of obtained gain was L.E. /Kg.**

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تأثير مصدر البروتين على الأداء الأنتاجى، القيمة الهضميه، تخمرات الكـرش، خصـائص الدم فىالحملان النامية

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استخدم فى هذه الدراسه ٢٠ من الأغنام النامية المحليه بمتوسط وزن ٣٣ ،٣٥ كم قسمت عشوائيا الى اربعة مجموعات متساويه (٥حيوانات/مجموعة) :-

المجموعةالأولى:- استخدمت كمجموعة مقارنة (ضابطه) حيث تم تغذيتها علـى العلـف المخلـوط المركز ، دريس البرسيم ، قش الأرز (بنسبة٧٠، ١٥ ،١٥ % عل الترتيب) ، المجموعة الثانية و الثالثة استخدم كسب عباد الشمس او فرشة دجاج اللحم بنسبة ٢٠% من الماده الجافه الكليه بينما المجموعة الرابعـة اسـتخدم مخلوط من عباد الشمس وفرشة دجاج اللحم بنسبة ٢٠% (١:١) من المادة الجافه الكليه.

اوضحت النتائج مايلى :-

- زيادة معدل الماكول من الماده الجافه والمركبات الكلية المهضومة والبروتين الخام فى العلائق المختبرة عـن مجموعة المقارنة عند مستوى معنوية (٥ %) .
- أظهرت العلائق المختبرة تحسن معنوى فى معدلات هضم الألياف والبروتين الخام عن مجموعة المقارنة.
- كما اظهرت قياسات الكرش لمجموعة المعاملة الثالثة والرابعة ارتفاع قيمة كل من الأحماض الدهنية الطياره الكليه والحموضه بينما أعطت المعامله الثالثة أعلى القيم عند كل الأوقات .
- أوضحت النتائج أن محتوى بلازما الدم من البـروتين الكلـى والألبيـومين والجلـوبيلين و أزوت اليوريـا والكرياتين وانزيمات الكبد لم تتاثر معنويا بين مجموعات المعاملة .
- كما أوضحت النتائج ايضا أن المعامله الثانيه (مجموعة عباد الشمس) أعطت أفضل أداء انتاجى فى معدلات النمو وكان العائد الأقتصادى فى العلائق المختبره أفضل من عليقة الكنترول .

لذا يمكن التوصيه بادخال كل من كسب عباد الشمس، فرشة دجاج اللحم (بعد تجفيفهـا للـتخلص مـن المسببات المرضيه بها) كمصادر علف غير تقليديه فى علائق الأغنام النامية المحلية لخفض التكلفه الأقتصـادية للعلائق مما يزيد من العائد النهائى للمنتج .