EFFECT OF NIGELLA SATIVA SUPPLEMENTATION ON LAMBS RESPONSES TO DIETARY SUPPLEMENT OF RUMEN DEGRADABLE NITROGEN

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ABSTRACT

The effect of three levels of rumen degradable nitrogen (1.0 , 1.3 and 1.6 g RDN / MJ of ME) and two levels of Nigella Sativa (0 and 7.5 g NS / kg DM) upon live-weight gain ,feed conversion ratio and some blood parameters were investigated in a 2x3 factorial experiment. Twenty four individual Karadi male lambs were used. They were weighing approximately 30 kg live weight and 6-7 months old at the start of the experiment. Two lambs were randomly allocated from each diet in order to determine some blood parameters. The diets were formulated to be given a 40 parts NaoH-treated barley straw DM to 60 parts concentrate DM.

There were no differences in daily feed Intake of DM, OM, ME and UDN across treatments. The live weight gain differences for overall period and feed conversion ratio were not significantly affected by increasing level of RDN, ; However, live weight gain and FCR were significantly ($P<0.05$) improved with those lambs fed diets supplemented with NS as compared with those fed diets with out NS. Interaction between level of RDN and NS was not statistically significant.

There was no significant effect of RDN and NS additives on growth hormone (GH) and blood sugar (BS), However, GH and BS of lambs fed 1.3 g RDN/MJ of ME either with or with out NS was slightly higher ($p>0.05$) than those fed other treatments. Blood Urea Nitrogen (BUN) was significantly ($p<0.01$) affected by the levels of RDN and NS supplementation .Lamb fed increasing levels of RDN was significantly ($p<0.01$) increase BUN, while NS additives significantly ($p<0.01$) reduced BUN.

INTRODUCTION

All animal diets have the same basic goal, to provide nutrients in adequate amounts and proportions to meet the maintenance and production requirements of the animals while avoiding waste and over feeding. Providing nutrients in excess of animal requirements results in increased costs of production and contributes to environmental problems Hansen (11). Therefore, protein system were efforts to maximize efficiency, and minimize the loss of nutrients in particular term by ARC (6) and NRC (29) were recommended. that the protein requirement for ruminant animals is a combination of the need of rumen micro-organism (Rumen degradable N, RDN) and of the host animal (Rumen un degradable N,UDN).In the specific case of lambs weighing in excess of 30 kg, ARC 1984 has proposed that the nitrogen requirement may, in most instances, be met by microbial protein only, and thus, that only RDN is required in the diet However, Hassan and Al-sultan (16) indicated that frequency of feeding significantly increase responses to dietary supplement of RDN above ARC (6) recommendation. Protein supplementation and natural feed additives are very important material that can improve, growth rate, feed efficiency utilization and carcass characteristics of growing lambs Hassan et al. (15), Al-Jassim et al. (3),

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Saarela et al (30), Hassan (13), Mohamed et. al. (27), Mahrous and Abou Ammou (25), Hassan and Mohmed (22), Hassan (14). Hassan and Hassan (20,21). In contrast, blood urea nitrogen (BUN) analyses can be used as a signal red to point out potential problem in the feeding program. The BUN level in excess of 18 to 20 mg/dl can be associated with lower reproductive performance, higher feed costs, health problems and poor production Hansen (11). Therefore, the observed responses to feed additives need more explanation and some possible reasons has this responses may need to explain the beneficial of additives feed in the diet.

The objective of this experiment was to maximize the efficiency utilization of RDN by providing feed additives such as Nigell Sativa (NS) in quantities sufficient to ensure productivity Hassan (14) and its effects on live weight gain, feed conversion ratio and some blood parameters.

MATERIALS AND METHODS

Experimental design and diets

The effect of three levels of rumen degradable nitrogen (1 ,1.3 and 1.6 g RDN / MJ of ME) and two levels of Nigella Sativa (0 and 7.5 g NS / kg DM) upon live-weight gain ,feed conversion ratio and some blood parameters were investigated in a 2x3 factorial experiment using a randomized block design with 4 replicates per cell of the design .

Diets were formulated to provide three ratios of RDN:ME and two levels of NS and a constant daily intake of UDN and metabolizable energy across treatments. This was achieved by using both untreated soybean meal (SBM) and formaldehyde-treated soybean meal (FTSBM) in the diets and substituting untreated SBM for FTSBM as RDN:ME ratios increased (see Table 1 and 2) .Barley and yellow corn were chosen as the basal ingredients for the diets because they have low N concentration. SBM (all of USA origin) was chosen as the source of RDN because the N content is reputed to be largely rumen degradable. FTSBM was used as the source of rumen un degradable nitrogen (UDN), because the N content is reputed to be largely un degradable N. The disappearance of N from the feedstuffs in the rumen was estimated by using the values reported by Hassan and Al-sultan (16,17). The barley, yellow corn and soybean meal and other protein supplements and minerals were mixed and offered as a concentrate fed separately from the treated barley straw. The diets were formulated to be given a 40 parts NaOH-treated barley straw DM to 60 parts concentrate DM. Chemical composition of the feedstuff and formulation and chemical composition of experimental diets are shown in table 1 and 2 respectively.

Table 1:Chemical composition of the feedstuff (g /kg DM)

Chemical composition	Ingredients*			
	Soybean meal	FSBM**	Yellow corn	Nigella Sativa
Dry matter g/kg fresh	946	944	937	919
Organic matter (OM)	881	880	927	913
Total nitrogen (TN)	70	70	13	41
Crude fiber (CF)	50	50	36	67
Ether extract (EE)	22	22	34	115
Nitrogen free extract (NFE)	245	245	812	433
Metabolizable energy (MJ)***	9.6	9.6	13.6	15.5

* NaoH-treated barley straw containing (DM basis): 87% OM , 0.59 % N, 8% NDF, 5% ADF, and 45% organic matter digestibility ,OMD.

** FSBM= Formaldehyde-treated soybean meal .

***ME (MJ/ kg DM) = 0.012 CP +0.031 EE+0.005 CF +0.014 NFE (MAFF,1975).

Table 2:Formulation and chemical composition of experimental diets

Level of Nigell Sativa (LNS)	Without Nigella Sativa			With Nigella Sativa		
Level of rumen degradable N (g / ME)	1	1.3	1.6	1	1.3	1.6
Diet no.	1	2	3	4	5	6
Ingredients (g / kg DM)	-	-	-	-	-	-
NaoH-treated barley straw	400	400	400	400	400	400
Yellow corn	460	420	355	452.5	412.5	347.5
Soybean meal(SBM)	75	135	220	75	135	220
Formaldehyde-treated SBM	40	20	-	40	20	-
Nigella Sativa	-	-	-	7.5	7.5	7.5
Urea	5	5	5	5	5	5
Min. and vit. Mixture	20	20	20	20	20	20
Chemical composition (g/kg DM)	-	-	-	-	-	-
Total nitrogen (TN)	19.84	23.73	27.94	19.94	23.89	28.04
Rumen degradable N(RDN)	12.74	16.59	20.54	12.74	16.59	20.54
RDN g / MJ of ME	1	1.3	1.6	1	1.3	1.6
Rumen undegradable N	7.1	7.2	7.0	7.2	7.3	7.1
Metabolizable energy (MJ)	12.7	12.7	12.7	12.7	12.7	12.7
Neutral detergent fiber (NDF)	310	311	312	310	311	308
Acid detergent fiber (ADF)	211	214	219	211	214	219
Hemi cellulose	98.9	96.3	92.2	98.9	96.3	92.2
Cellulose	152.2	153.1	154.5	152.3	153.1	154.5
Lignin	59.0	61.2	64.9	59.0	61.3	64.9

Formaldehyde-treated soybean meal

Formaldehyde treatment of SBM was by spraying formaldehyde solution on the meal at the ratio of 10 ml /100 g SBM DM, equivalent to 1 g formaldehyde per 100 g crude protein Hassan et al. (15), mixing well and then packing in polyethylene bags. Bags were sealed and left at room temperature (25 C^0) for 48 h and shaken occasionally .After 48 h , treated SBM was air-dried in trays for 24 h to remove excess formaldehyde.

Making NaOH - treated barley straw

The barley straw used in this experiment was ground and treated with NaoH at rate of approximately 40g/kg DM as following: NaOH was applied by spraying equal weight of NaOH solution on straw to provide a treatment level of 40 g NaOH per kg straw DM. The sprayed straw was mixed well to bring NaOH solution into contact with straw as completely as possible .The freshly- made material was covered with polyethylene nylon for approximately 2-3 weeks to absorb moisture that formed during the heating process. The chemical composition of treated barley straw is shown in table (1).

Animals and management

Twenty four individual Karadi male lambs were used. They were weighing approximately 30 kg live weight and 7 months old at the start of the experiment. Four lambs were randomly allocated from live weight block to each treatment. Two lambs were randomly allocated from each diet in order to determine some blood parameters. The lambs were individually housed in pens (1x1.3 m) that allowed access to diets supplied in mettle bucket fixed in side the pen .Water was available at all times. The diets was gradually introduced to the lambs over a period of 3 weeks before the start of the experiment. During this time the lambs were vaccinated against clostridia diseases. The diets were offered once daily at about 08.00 hour (h) in quantities calculated to support

maintenance and daily gain of 200g Al-Jassim et.al. (4). Allowance were recalculated each 2 weeks according to live weight. NaoH-treated barley straw and Feeds refusal were collected and weighed back daily. Offered and refusal feeds were sampled and stored at -15C^0 for subsequent chemical analysis.

The lambs were weighed each two weeks to nearest 0.5 kg, at the same time each day .Recording of daily intake and live weight gain was maintained for 9 weeks.

Determination of some blood parameters

Within 2-3 days before ending the feeding trail, blood samples were taken from half (10 lambs) of the experimental animals to determine plasma growth hormone, blood sugar and urea nitrogen concentration. Animals were fitted with jugular canella and blood samples (3 ml) were drawn into heparin zed syringe before morning feeding (zero time) and 3, 6, 9 12 and 24 h after morning feeding. Blood samples were centrifuged and plasma was removed and stored at -20 C ^{o} until analysis for growth hormone, sugar, blood urea nitrogen and serum uric acid using a radioimmunoassay technique, international, France. Mean plasma concentration were calculated for all times for each animal within each treatment group.

Chemical analysis

Samples of feedstuffs, feed offered and refusals were dried at 50 C^o until constant weight before chemical analysis .Samples than ground through a 1mm screen for chemical analysis. DM,OM,TN,EE,CF and NFE were determined for all feedstuffs according to A.O.A.C. (7). Neutral detergent fiber (NDF), Acid detergent fiber (ADF) and lignin were determined by the method of Goering and Van soest (10). In Vitro DM and OM digestibility of NaoH-treated barley straw was determined by the method of Tilley and Terry (34).

Statistical analysis

Data was statistically analyzed using Completely Randomized Design Model (CRD) procedure by SAS (32) between treatments means Duncan (8). Analysis of variance was carried out on all data. The treatment was partitioned into main effects and their interaction.

RESULTS AND DISCUSSION

Intake

The lambs were onsumed all the iets offered. The overall daily intake of DM OM, NDF,ADF, lignin, ME,TN, RDN and UDN are presented in Table3. There were no differences between treatments in daily DM,OM,NDF,ADF, Hemi cellulose, cellulose, lignin and UDN intake when expressed as g/day or g/kg W$^{0.75}$. The RDN:ME ratio and daily intake of total N were followed the intended treatments composition ($P<0.01$).

Live-weight gain

Live –weight gain is presented for the first 4 weeks, the second 4 weeks and the overall experimental period (Table 4.). Live-weight gain in the second part of the experiment was greatly higher than the first part for all treatments ;except the lambs given high level of RDN with out NS (Diet 3). The pattern of responses to RDN and NS varied between the first, second parts and overall of the experiment.

In the first part, the lamb on all treatments grew below the predicted value of 200 g/day; moreover, differences in live weight gain were not statistically

significant between treatments. There were no responses to increasing levels of RDN or NS.

During the second part of the experiment, the lambs on all treatments grew above or close to the predicted value of 200 g/day, except the lambs fed diet 3 grew 52g/day below the target value of 200 g/day. Lambs responses to dietary supplement of RDN in this period was quadratic relationship and higher responses was achieved with level of 1.3 g RDN /MJ of ME. While, lambs receiving supplement diets with NS (Diets 4,5and 6) grew significantly (P<0.01) faster than those lambs fed diets without NS. but, there was a level of LNS x LRDN interaction (P<0.05).

Finally, The live weight gain differences for overall period and feed conversion ratio were not significantly affected by increasing level of RDN ;However, live weight gain and FCR were significantly (P<0.01) improved with those lambs fed diets supplemented with NS (Diets 4,5 and 6) as compared with those fed diets with out NS. Interaction between level of RDN and NS was not statistically (p>0.05) significant.

Blood parameters

Growth hormone (GH), Blood sugar (BS), Blood urea nitrogen (BUN) and Serum uric acid (SUA) of lamb fed the experimental diets are presented in table (Table 5.). There was no significant effect of RDN and NS additives on GH and BS ; However, GH and BS of lambs fed 1.3 g RDN/MJ of ME either with or with out NS was slightly higher (p>0.05) than those fed other treatments .Interaction between level of RDN and NS was not significant. Urea Nitrogen was significantly (p<0.01) affected by the levels of RDN and NS supplementation .Lamb fed increasing levels of RDN was significantly (p<0.01) increase BUN, while NS additives was significantly (p<0.01) reduce BUN.

Level of RDN and NS was significantly (p<0.05) effect on SUA. Increasing levels of RDN with out NS was significantly (p<0.05) reduce SUA, but for those fed RDN with NS was significantly (p<0.05) increase SUA. Interaction between level of RDN and NS was not significant.

The experiment was designed to provide similar intakes of ME and UDN across treatments .In spit off our expectation that the lambs fed diets 1 and 4 had lower RDN than ARC (6) recommendation may be has lower intakes than predicted, since there was a significant depression in the digestibility of ADF Hassan (12). In sheep given diets estimated to be only moderately deficient in RDN, fiber digestion in the rumen McAllan and Smith (26) was depressed. Since the lambs consumed similar amount of ME and UDN across treatments so any change in responses to dietary supplement of RDN in this experiment is mainly related to NS additives. Greater gains during the late part compared to the early part of the growth periods have been agree with results reported by Hassan and Hassan (20,21) and different than other results reported by Hassan (12), Hassan and Bryant (18,19) and since they are generally common to all diets may merely represent changes in gut fill. Therefore, in the absence of evidence to the contrary, it would seen safer to accept the results of overall growth period as a fairer representation of RDN and NS feed additives effects on live weight gain and feed conversion ratio. Its appeared that the lambs response to increasing the dietary RDN concentration was curvilinear and similar to that presented by ARC (6). In this experiment the minimum level of RDN achieved maximum response is 1.3 g RDN/MJ of ME, above this ratio no further response occurred. This results is in agreement with those reported by Hassan (12) and Al-sultan

(17). However ,lambs fed diets supplemented with NS grew faster than those with out, particularly those lambs fed RDN below ARC (6) recommendation. There are some reasons which may explain the beneficial effect of NS to improve the efficiency utilization of RDN in this study. El-Saadany et al. (9), Allam et al., (5), Aboul-Fotouh et al. (1), Abou ward (2), Karimi and Rahimi (23), Mahrous and Abou-Ammou (25) reported that medicinal plants and anther feed additives (probiotics) improved rumen activity and nutrient digestibility. This improvement in rumen activity and nutrient digestibility might be increased the efficiency utilization of RDN in this experiment, In addition such additives might be reduce the rate of nutrient passage in elementary tract and give more time for utilization and absorption of nutrients Wu et. al. (35), Shim (33), Moreovers supplemented with NS was sport the hypothesis that, blood urea nitrogen (BUN) analyses can be used as a signal, or red flag to point out potential problem in feeding program. BUN level in excess of 18 to 20 mg/dl in cow can be associated with lower reproductive performance, higher feed costs, health problems, and poor production Hansen (11). Similar results were reported by Mohamed et al. (28) who calculated that the nutritive values as TDN, ME and DCP were improved significantly as a result to medicinal plants (NS) supplementation .These results are in agreement with results obtained by Salem and El-Mahdy (31) and Mohamed et al. (27) who reported that the medicinal plants (NS and Metrical chamomile) additives improved the digestion coefficient and nutritive value during feeding sheep.

It must also be acknowledged that supplementation of the diet with feed additives provided additional minerals, of those minerals, phosphorus was most likely to have been in deficit. ARC (6) proposes a daily requirement of phosphorus of 2.1 g/ kg DM for a lamb gaining 200 g. The control diet contained 3.8 g/kg DM. It therefore seems unlikely that phosphorus was limiting.

Table 3: Overall daily feed intake of nutrients

Level of Nigell sativa (LNS)	Without Nigella sativa			With Nigella sativa			Se of means and significance of effects			
RDN: ME ratio (g / MJ of ME)	1	1.3	1.6	1	1.3	1.6				Interaction
Diet no.	1	2	3	4	5	6	SEM	LNS	LRDN	LNSxLRDN
Dry matter (g/day)	1209	1195	1215	1190	1215	1217	28.1	NS	NS	NS
(g/kgW$^{0.75}$ per day)	75.69	75.1	77.19	75.85	77.19	75.3	2.036	NS	NS	NS
Organic matter (g/day)	1084	1074	1081	1075	1091	1078	27.0	NS	NS	NS
(g/kgW$^{0.75}$ per day)	67.8	67.4	68.6	68.4	69.3	67	1.951	NS	NS	NS
Metabolizable energy (MJ / day)	15.35	15.06	15.18	15.12	15.3	15.13	0.374	NS	NS	NS
(g/kgW$^{0.75}$ per day)	0.96	0.94	0.96	0.96	0.97	0.94	0.028	NS	NS	NS
Total nitrogen (g/day)	23.98	28.37	33.94	23.74	29.0	33.9	1.180	NS	**	NS
(g/kgW$^{0.75}$ per day)	1.5	1.78	2.15	1.51	1.84	2.10	0.082	NS	**	NS
Rumen degradable N (g/day)	15.4	19.83	24.95	15.17	20.15	24.86	0.995	NS	**	NS
(g/kgW$^{0.75}$ per day)	0.96	1.24	1.58	0.96	1.28	1.54	0.070	NS	**	NS
(g / MJ of ME)	1	1.3	1.6	1	1.3	1.6	0.012	NS	**	NS
Rumen undegradable N (g/day)	8.58	8.54	8.99	8.57	8.85	9.04	0.220	NS	NS	NS
(g/kgW$^{0.75}$ per day)	0.53	0.53	0.57	0.54	0.56	0.56	0.095	NS	NS	NS
Neutral detergent fiber (NDF)	375	372	379	369	378	372	9.380	NS	NS	NS
Acid detergent fiber (ADF)	255	256	267	252	260	266	6.567	NS	NS	NS
Hemi cellulose	119	115	112	117	117	107	2.954	NS	NS	NS
Cellulose	184	183	188	181	186	187	2.82	NS	NS	NS
Lignin	71	73	79	70	74	79	1.996	NS	NS	NS

** P<0.01, NS , not significant.

Table 4: Live weight gain and feed conversion ratio of lambs as affected by increasing level of rumen degradable nitrogen (RDN) and Nigella sativa (NS) supplementation

Level of Nigell sativa (LNS)	With out Nigella sativa			With Nigella sativa			Se of means and significance of effects			
RDN: ME ratio (g / MJ of ME)	1	1.3	1.6	1	1.3	1.6	-		-	Interaction
Diet no.	1	2	3	4	5	6	SEM	LNS	LRDN	NS x RDN
Initial live weight (Lw , Kg)	33.83	33.93	33.95	33.75	33.95	33.975	0.375	NS	NS	NS
Final Lw (Kg)	44.6	46.2	44.9	46.65	46.75	47.75	0.451	*	NS	NS
Live- weight gain (g/day)	-	-	-	-	-	-	-	-	-	
0 – 4 weeks	172	167	180	187.5	177	172	13.13	NS	NS	NS
4 – 8 weeks	184	214	148	214.0	236	236	10.24	**	NS	*
0 – 9 weeks	171	195	174	205	203	211	8.03	**	NS	NS
Feed Conversion ratio	-	-	-	-	-	-	-	-	-	
(g DM intake /g LWG)	7.58	7.11	7.46	6.23	6.32	6.17	0.214	**	NS	NS

*P < 0.05 , ** P<0.01 , NS , not significant.

Table 5: Blood parameters of Karadi lambs as affected by increasing level of rumen degradable nitrogen and Nigella Sativa supplementation

Level of Nigell sativa (LNS)	Without Nigella sativa			With Nigella sativa			Se of means and significance of effects			
RDN: ME ratio (g / MJ of ME)	1	1.3	1.6	1	1.3	1.6	Interaction			
Diet no.	1	2	3	4	5	6	SEM	LNS	LRDN	LNSxLRDN
Blood parameters (mg / l)										
Blood sugar	58.87	68.4	55.6	63.25	58.9	70.75	1.810	NS	NS	NS
Serum uric acid	0.68	0.35	0.32	0.39	0.55	0.61	0.037	*	NS	NS
Growth hormone	2.96	3.13	2.65	2.86	3.3	2.91	0.120	NS	NS	NS
Blood urea nitrogen	38.0	41.1	47.7	31.8	33.3	37.6	1.296	**	**	NS

*P < 0.05 , ** P<0.01, NS, not significant.

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تاثير اضافة الحبه السوداء في استجابه الحملان الكراديه لنتروجين الغذاء المتحلل في الكرش

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الملخص

أستخدم اربعة وعشرون حملا"كراديا" بعمر6-7 اشهروبمتوسط وزن 30كغم وضعت في أقفاص مفرده لدراسة تأثير استخدام ثلأثة مستويات من النتروجين المتحلل في الكرش (1 , 1.3 و1.6 غم/ميكاجول طاقه متأيضة) ومستويين من الحبه السوداء (0 و7.5 غم / كغم ماده جافه) في كمية المتناول اليومي, معدل زيادة الوزن، كفاءة التحويل الغذائي وبعض صفات الدم .قسمت الحملان الى 6 مجموعات متساوية وغذية على 6 علائق مختلفة مكونه من 60%علف مركز و40% تبن معامل بالصودة الكاوية. أخذت نماذج من الدم لتقدير هرمون النمو، سكر الدم ، نتروجين يوريا الدم وبلازما حامض اليوريك خلال ألاسبوع ألاخير من التجربة.

أظهرت النتائج عدم وجود اختلافات معنويه بين المعاملات المختلفه في المتناول اليومي من المادة الجافة والعضوية والطاقة المتأيضة والنتروجين غير المتحلل في الكرش. زيادة مستوى النتروجين المتحلل في العليقه لم يؤثر معنوياً في معدل الزياده الوزنية اليوميه وكفائة التحويل الغذائي. في حين اظهرت الحملان المغذاة على الحبه السوداء تحسناً معنوياً (P<0.05) في معدل زياده الوزن اليوميه وكفاءة التحويل الغذائي مقارنةً بتلك الحملان المغذاة على علائق لاتحتوي على الحبة السوداء، مع عدم وجود تداخل معنوي بين مستوى النتروجين المتحلل والحبة السوداء.

ان زيادة مستوى النتروجين المتحلل واضافة الحبة السوداء لم تظهر تأثيراًً معنوياً على هرمون النمو وسكر الدم, مع ذلك فأن الحملان المغذاة على مستوى 1.3 غم نتروجين متحلل / ميكاجول طاقة متأيضة اظهرت زيادة غير معنوية في هرمون النمو وسكر الدم مقارنة مع المعاملات الاخرى. كما اظهرت النتائج ان زيادة مستوى النتروجين المتحلل في العليقة ادى الى زيادة معنوية (p<0.01) في مستوى يوريا الدم. في حين ادت ان اضافة الحبة السوداء الى انخفاض معنوي (p<0.01) في مستوى يوريا الدم.

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