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Full Length Research Paper

Carcass characteristics of Karadi lambs as affect by different levels of dietary supplement of rumen degradable nitrogen fed with *Nigella sativa*

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The objective of the work described here was to investigate the effect of two levels of *Nigella sativa* (0 and 7.5 g NS / kg DM) supplementation to rations of Karadi lambs fed three levels of rumen degradable nitrogen (1, 1.3 and 1.6 g RDN / MJ of ME) on carcass characteristics, using 2 x 3 factorial experiment. Twenty four individual Karadi male lambs were used (four lambs for each treatment). They were weighing approximately 30 kg live weight and 7 months old. The diets were formulated to be given at 40% NaOH-treated barley straw DM to 60% concentrates DM. At the end of feeding trial, all the lambs were slaughtered after over night with feeding straw. Live weight gain was improved ($P < 0.05$) in lambs fed diets supplemented with NS as compared with those lambs fed diet without NS. However, live weight gain was not affected by levels of RDN. Changes in slaughter weight, Killing out proportion, leg cuts tissue, the wholesale cuts weight and fat-tail weight were not significantly affected by both NS supplementation and levels of RDN. However, the heavier slaughter weights, cold carcass and fat tail weights were associated with lambs fed highest level of RDN supplemented with NS ($P < 0.05$). Moreover, there is a linear increase in fat-tail weight associated with lambs fed increasing levels of RDN supplemented with NS.

Keyword: Karadi, Lambs, Carcass characteristics, Rumen degradable nitrogen, *Nigella Sativa*.

INTRODUCTION

It is well understood that the protein requirement for ruminant animals is a combination between the need of rumen micro-organism in form of rumen degradable nitrogen (RDN) and of the host animal in form of rumen undegradable nitrogen (ARC, 1984; NRC, 2001). 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 (1995a) indicated that frequency of feeding significantly increased responses to dietary supplement of RDN above ARC (1984) recommendation. In contrast, natural feed additives such as medicinal plants are very important material that can improve feed efficiency utilization, growth rate and carcass characteristics of growing lambs (Saarela et al., 2000; Mohamed et al., 2005; Hassan, 2009; Hassan and Hassan, 2009a; Hassan and Hassan, 2010). Recently, Hassan (2009) found that *Nigella sativa* (NS) supplemented to the concentrate diets clearly improved live weight gain, carcass characteristics and lean to fat ratio of Awassi lambs. Thus, the first part of this study was conducted to maximize the efficiency utilization of increasing levels of RDN above ARC recommendation (1.34 g RDN /MJ of ME) by providing NS as feed additives on daily feed intake, live weight gain, feed conversion ratio and some blood parameters of Karadi lambs (Hassan and Hassan, 2009b). While the objective of this part was to study the effect of increasing

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Abbreviations: RDN, Rumen degradable nitrogen; **NS,** *Nigella sativa*; **SBM,** soybean meal; **FTSBM,** formaldehyde- treated soybean meal; **UDN,** undegradable nitrogen; **CRD,** completely randomized design; **FCR,** feed conversion ratio; **LWG,** live weight gain; **CCW,** cold carcass weight; **TN,** total nitrogen; **MJ,** metabolizable energy.

Table 1. Formulation and chemical composition of experimental diets.

Level of *N. sativa* (LNS)	Without *N. sativa*			With *N. sativa*		
Level of rumen degradable N (g / MJ ME)	1	1.3	1.6	1	1.3	1.6
Diet number	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
Mineral and vitamin 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

*NaoH-treated barley straw containing (DM basis): 87% OM, 0.59% N, 8% NDF, 5% ADF and 45% organic matter digestibility. **ME (MJ/ kg DM) = 0.012 CP +0.031 EE+0.005 CF +0.014 NFE (MAFF, 1975).

levels of RDN above ARC recommendation by providing NS as feed additives on slaughter weight, carcass weight, killing out proportion and tissue in leg cut of Karadi lambs.

MATERIALS AND METHODS

Experimental design and diets

The effect of three levels of RDN (1, 1.3 and 1.6 g RDN / MJ of ME) and two levels of NS (0 and 7.5 g NS / kg DM) on carcass characteristics were investigated in a 2 x 3 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. Barley and yellow corn were chosen as the basal ingredients for the diets because they have low N concentration. SBM 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 undegradable nitrogen (UDN), because the N content is reputed to be largely undegradable N. The disappearance of N from the feedstuffs in the rumen was estimated by using the values reported by Hassan and Al-sultan (1995ab). The concentrate diets were fed separately from the treated barley straw. The diets were formulated to be given 40:60 roughage to concentrate ratio. Formulation and chemical composition of the experimental diets are shown in Table 1.

Treated soybean meal and barley straw

Formaldehyde treatment of SBM was prepared as described by Hassan et al. (1991). The barley straw used in this experiment was ground and treated with NaOH at the rate of approximately 40 g/kg 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 two - three weeks to absorb moisture that formed during the heating process.

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. The lambs were individually housed in pens (1 x 1.3 m). Water was available at all times. The diets were gradually introduced to the lambs over a period of three weeks before the start of the experiment. The diets were offered once daily in quantities calculated to support maintenance and daily gain of 200 g (Al-Jassim et al., 1996). Allowances were recalculated each two weeks according to live weight. 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 nine weeks.

Determination of carcass characteristics

At the end of feeding trial, the lambs were slaughtered after over night with feeding straw. Slaughter was performed according to local Muslim practice by severing the jugular vessels, the esophagus and the trachea without stunning. Carcasses were weighed and chilled for 24 h at 4°C weighted again and cut into left and right sides, after removing the fat tail from the carcasses. The left side was cut into standardized wholesale cuts (Forrest et al., 1975). The cuts were weighed separately, while leg cuts were dissected into lean, bone and fat tissue. Since Hassan et al. (1990) reported that leg was the best cuts representative for lean, bone and fat carcass

Table 2. Live weight gain and carcass characteristics of Karadi lambs as affected by increasing level of rumen degradable nitrogen (RDN) and *N. sativa* (NS) supplementation.

Level of *N. sativa* (LNS)	0.0			0.75			SE of means and significance of effects			
RDN: ME ratio (g / MJ of ME)	1	1.3	1.6	1	1.3	1.6				
Diet no.	1	2	3	4	5	6	SEM	LNS	LRDN	NS x RDN Interaction
Dry matter (DM, g/day)	1209	1195	1215	1190	1215	1217	28.1	NS	NS	NS
RDN(g / MJ of ME)	1	1.3	1.6	1	1.3	1.6	0.012	NS	**	NS
Total N (g/day)	23.98^c	28.37^b	33.94^a	23.74^c	29.0^b	33.9^a	1.180	NS	**	NS
ME (MJ / day)	15.35	15.06	15.18	15.12	15.3	15.13	0.374	NS	NS	NS
Initial live weight (kg)	35.60	35.73	34.73	33.27	32.93	35.97	1.102	NS	NS	NS
Final live weight (kg)	45.10^b	45.55^{ab}	44.08^b	43.50^b	43.33^b	48.30^a	0.963	NS	NS	*
Live- weight gain (LWG, g/day)	151^b	156^b	148^b	162^b	165^b	196^a	8.15	*	NS	*
Slaughter weight (kg)	46.3^b	46.5^b	44.17^b	43.53^b	43.67^b	49.80^a	1.148	NS	NS	*
Cold carcass weight (kg)	22.80	23.35	22.28	22.76	21.96	24.73	0.352	NS	NS	NS
Killing out proportion(g/kg)	492	502	505	523	503	497	6.72	NS	NS	NS
Tissue in leg cut (kg)										
Lean	2.124	2.141	1.985	2.229	1.960	2.146	0.040	NS	NS	NS
Subcutaneous fat	0.409	0.519	0.469	0.345	0.436	0.494	0.051	NS	NS	NS
Intermuscular fat	0.094	0.106	0.106	0.097	0.082	0.078	0.005	NS	NS	NS
Bone	0.685	0.742	0.633	0.733	0.702	0.739	0.017	NS	NS	NS
FCR (g DM /g LWG)	8.0^b	7.7^b	8.2^b	7.3^b	7.4^b	6.2^a	0.310	*	NS	*

*P < 0.05; ** P < 0.01; NS, not significant; abc means within rows with different superscripts are significantly different (P < 0.05); FCR = feed conversion ratio; SE = Standard error.

tissue.

Chemical analysis

Feedstuffs, offered and refusals were chemically analyzed according to A.O.A.C. (1995) and Goering and Van Soest (1970). *In vitro* OM digestibility of barley straw was determined by the method of Telley and Terry (1963).

Statistical analysis

Data was statistically analyzed using Completely Randomized Design Model (CRD) procedure by (SAS, 2001). Duncan's multiple range tests was used to determine the significance of differences between treatments means (Duncan, 1955). Analysis of variance was carried out on all data. The treatment was partitioned into main effects and their interaction.

RESULTS AND DISCUSSION

The lambs consumed all the diets offered. The effects of increasing levels of RDN and NS supplementation on daily nutrients intake, live weight, live weight gain (LWG), slaughter and cold carcass weight (CCW), killing out proportion and tissue in leg cut are presented in Table 2. Since the diets were offered in quantities calculated to support maintenance and daily gain of 200 g, differences in daily nutrients intake among treatments were not statistically significantly. The RDN: ME ratio and total N intake were followed by the intended treatments composition (P < 0.01). Live weight gain and feed conversion ratio (FCR) were improved (P < 0.05) in lambs fed diets supplemented with NS as compared with those lambs fed diet with out NS. Live weight gain and FCR were not significantly affected by levels of RDN. But there was a level of RDN x NS interactions (P < 0.05) mainly because improvement being proportionately greater in lambs fed higher level of RDN supplemented with NS (Diet 6), whereas no differences in leg cut tissue (lean, subcutaneous fat, intermuscular fat and bone) among treatments. Many studies (Abul-Fotouh et al., 1999; Allam et al., 1999; El-Saadany et al., 2001; Mohamed et al., 2005; Hassan, 2009; Hassan and Hassan, 2009c) reported a clear improvement in live weight gain when lambs fed restricted concentrate diets supplemented with medicinal plants such NS and Rosemary. In contrast, no improvements in live weight gain when lambs fed with concentrate diets plus NaOH treated or untreated barley straw supplemented with NS (Hassan and Hassan, 2010). However, these improvements in LWG were not associated with significant changes in carcass characteristic and leg cuts tissue, while Al-Rubeii and Hassan (2009) and Hassan (2009) obtained that responses to NS in term of LWG were associated with significant changes in carcass characteristic and produce leaner gain. However, the mechanisms of the NS effect are still unknown (Huck et al., 2000) and more details are required in order to

Table 3. Performance of Karadi lambs as affected by *N. sativa* fed with different levels of RDN on weight cuts of half cold carcass weight, fat tail weight (kg) and perirenal fat, cardiac fat, omental fat and mesenteric fat.

Level of *N. sativa* (LNS)	0.0			0.75			SE of means and significance of effects			
RDN:ME ratio (g / MJ of ME)	1	1.3	1.6	1	1.3	1.6				
Diet no.	1	2	3	4	5	6	NS	SEM	RDN	NS x RDN interaction
Leg	3.40	3.37	3.17	3.32	3.15	3.53	0.054	NS	NS	NS
Loin	0.694	0.781	0.711	0.695	0.692	0.629	0.022	NS	NS	NS
Rack	0.807	0.733	0.779	0.669	0.785	0.833	0.030	NS	NS	NS
Shoulder	1.94^{bc}	2.01^{ab}	1.91^{bc}	2.18^{a}	1.74^{c}	2.25^{c}	0.017	NS	*	**
Neck	0.594	0.667	0.667	0.604	0.617	0.625	0.012	NS	NS	NS
Fore shank	0.595	0.547	0.579	0.619	0.547	0.609	0.009	NS	NS	NS
Breast	1.000	1.035	1.015	0.963	0.896	0.937	0.038	NS	NS	NS
Flank	0.239	0.172	0.212	0.199	0.157	0.201	0.011	NS	NS	NS
Fat tail(kg)	4.01^{b}	4.05^{b}	4.01^{b}	3.61^{c}	4.35^{b}	5.04^{a}	0.683	NS	NS	*
Perirenal fat (% of EBW)	0.15	0.17	0.16	0.18	0.15	0.16	0.04	NS	NS	NS
Cardiac fat (% of EBW)	0.07	0.05	0.05	0.08	0.07	0.06	0.02	NS	NS	NS
Omental fat (% of EBW(	0.55	0.50	0.51	0.51	0.50	0.53	0.12	NS	NS	NS
Mesenteric fat (% of EBW)	0.13	0.11	0.15	0.14	0.11	0.12	0.04	NS	NS	NS

* P < 0.05; ** P < 0.01; NS, not significant; abc means within rows with different superscripts are significantly different (P < 0.05); SE = Standard error.

clarify the effect of medicinal plants on LWG, carcass characteristic and physical changes in tissue to explain the nature of these improvements.

Final weight, slaughter weight and killing out proportion were not significantly affected by both NS supplementation and levels of RDN. But there was a level of RDN x NS interactions (P < 0.05); this interaction mainly related to significant increase in final weight and slaughter weight in lambs fed highest level of RDN supplemented with NS (Diet 6).

The effects of increasing levels of RDN and NS supplementation on main wholesale cuts and fat tail weights are presented in Table 3. The main wholesale cut weights expressed as g/kg CCW were not significantly different among treatments, with no interaction between level of RDN and NS supplementation except for shoulder cuts (P < 0.05). The differences in fat-tail weights between the NS and RDN treatments were not statistically significant. However, a tendency towards an increase in fat-tail weight was associated with lambs fed increasing levels of RDN supplemented with NS (Diets 4, 5 and 6). Therefore, the lambs fed diets supplemented with NS improved daily LWG, but this improvement was mainly fat deposition in fat tail. Huck et al. (2000) and Afaf (2001) reported that such additives increased the total volatile fatty acid produce in the rumen which causes differences in lipids thickness and its deposition in animal body. In contrast, as it is shown in Table 3, the levels of RDN and NS supplementation had no significant effect on perirenal fat, cardiac fat, omental fat and mesenteric fat.

REFERENCES

Abul-Fotouh GE, Allam El Shehata SM, Abd El-Azeem SN (1999). Effect of medicinal plants as feed additives on performance of growing sheep. Egyptian J. Nutr. Feeds, 2: 79-91.
Afaf MF (2001). Effect of uing yea-sacc on performance of sheep and goats in Sinai. Egyptian. J. Nutr. Feeds, 4: 67-73.
Agriculture Research Council (1984). The nutrient requirements of ruminant Livestock. Commonwealth Agricultural Bureaux ,Slough. p. 1.
Al-Jassim RAM, Hassan SA, AL-Ani AN (1996). Metabolizable energy requirements for maintenance and growth of Awassi lambs. Small Rumin. Res. 20: 239-245.
Allam S, Hoda El-Houseing M, Abdel-Gawad AM, El-Saadany SA, Zied AMM (1999). Medicinal herbs and plants as feed additives for ruminants. 1-Effect of using some medicinal herbs and plants as Feed additives on Zaraibi goat performance. Egyptian J. Nutr. Feeds, The 7th Conf. Animal Nutr. El-Arish, North Saini, 2: 265-279.
Al-Rubeii AMS, Hassan SA, Saleh HH (2009). Effect of Nigella sativa and Rosemery officinalis supplementation to ration of Awassi lambs in the physical,chemical characteristics of carcasses at cold storage (4ºC) .7th Scientific Conf. for Agric. Res. Iraq. 14(1) : 48–59.
AOAC (1995). Official Methods of Analysis .Association of Official Analytical Chemists, 16th Ed., Virginia, U.S.A.
Duncan DB (1955). Multiple ranges and multiple F test. Biometrics, 11: 1-12
El-Saadany SA, Abdel-Momin M, Abo-Ammou FF, Shehta E (2001). Effect of using two medicinal herbs and plant mixtures as feed additives on the performance of growing lambs. J. Agric. Sci. Mansoura Unvi. 26(9): 5321-5333.
Forrest JC, Aberle ED, Hedrick HB, Judge MD, Merkel RA (1975). Principles of Meat Science. W.H. Ereeman Co. San Francisco, CA., p.79.
Goering HK, Van Soest PJ (1970). Forage fiber and analysis (apparatus, reagents, procedures and some applications). USDA hand book. p. 379.
Hassan SA (2009). Effect of some medicinal plants supplementation on

daily intake,live weight gain and carcass characteristics of Awassi lambs. Egyptian J. Nutr. Feeds, 12(1): 65-73.

Hassan SA, AL-sultan AA (1995a). Awassi lambs responses to dietary supplement of rumen degradable protein 2-Effect of frequency of feeding. IPA J. Agric. Res. 5: 100-111.

Hassan SA, AL-sultan AA (1995b). Awassi lambs responses to dietary supplement of rumen degradable protein 1-Effects of forage to concentrate ratio. IPA J. Agric. Res. 5: 80-99.

Hassan SA, Al-Ani AN, Al-Jassim RAM (1990). Relationship between carcass physical composition and carcass parts in fat tail lambs. 36th Int. Cong. of Meat Science and Technol. Havana, June 14.

Hassan SA, AL-Jassim RAM, Al-Ani AN, Abdullah NS (1991). Effects of dietary supplement of rumen un degradable protein upon carcass composition of fat-tail Awassi sheep, Small Rumin. Res. 5: 65-74.

Hassan SA, Hassan KM (2009a). The effect of supplementation of medicinal plants and probiotic on growth rate and some blood parameters of karadi lambs. Egyptian J. Nutr. Feeds. 12(1): 53-63.

Hassan SA, Hassan KM (2009b). Effect of graded levels of rumen degradable nitrogen and Nigella Sativa on daily intake, live weight gain, feed conversion ratio and some blood parameters of karadi lambs. 7th Scientific Conf. for Agric. Res. Iraq. 14(5) :194-204.

Hassan SA, Hassan KM (2009c). Effect of different levels of rumen undegradable nitrogen and Nigella Sativa on daily intake, live weight gain, feed conversion ratio and some blood parameters of karadi lambs. Iraqi J. Agric. Sci. 40(1): 168-178.

Hassan SA, Hassan KM (2010). Response of Karadi lambs to the Rosemary officinal Supplementation fed with either alkali treated or untreated barley straw basal diets Egyption. J. Nutr. Feeds, (in press).

Huck GL, Kreikemeir R, Ducharme GA (2000). Effect of feeding two microbial additives in sequence on growth performance and carcass characteristics of finishing beef steers. Online Available.

MAFF (1975). (Ministry of Agriculture, Fisheries and Food Department of Agriculture and Fisheries for Scotland). Energy allowance and feeding system for ruminants, Technical Bulletin. p. 33.

Mohamed AH, Nadia M, Abd-El-Bar, Ibrahim K (2005). Influence of some medicinal plants supplementation. 2.Lambs performance, carcass properties and mutton meat quality. Egyption J. Nutr. Feed., 8(1): 445-460.

NRC (2001). Nutrient Requirements of Dairy Cattle. 7th Rev. ed. Natl. Acad. Sci., Washington, DC.

Saarela M, Mogensen G, Fonden R, Matto J, Mattila-Sandholm T (2000). Probiotic bacteria: safety, functional and technological properties. J. Biotechnol. 84: 197-215.

SAS (2001). SAS/STAT User's Guide for Personal Computers. Release 6.12. SAS. Institute Inc., Cary, NC, USA.

Telley JM, Terry RA (1963). A two stage technique for *in vitro* digestion of forage crops. J. Br. Grassland Sci. 18: 104-111.