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Effect of Feeding Different Levels from Heat Protected Soybean Meal Protein in Diets of Growing Rahmani Lambs on Digestibility Coefficients, Feeding Values and Growth Performance

El-Ayek, M. Y.[1] ; M. M. El-Moghazy[2] and H. A. Areda[2]

[1] Department of Animal Production, Faculty of Agriculture, Mansoura University, Egypt.

[2] Department of Animal Production, Faculty of Agriculture, Damietta University, Egypt.

***Corresponding Author (Mostafa El-Moghazy) E. Mail Address: el-moghazymm@yahoo.com.**

ABSTRACT

Fifteen weaning Rahmani lambs with an average live body weight 19±0.5 kg and 4 months age were randomly assigned into three groups (each of 5 lambs) to study the effect of heat protected soybean meal protein diets at 145°C in a forced air oven for 4 hrs on nutrients digestibility as well as feeding values and their reflection on growth performance of growing lambs. Animals were fed for 120 days feeding period on the same three experimental diets. Control fed diet containing soybean meal (15%) without treatment as a consists of CFM + clover hay. The T1 fed diet containing (50% soybean meal protected + 50% soybean meal unprotected) as consists of CFM + clover hay. The T2 fed diet containing 100% soybean meal protected as consists of CFM + clover hay animal were fed in groups. Digestibility coefficients were determined using acid insoluble ash (AIA%) as natural marker. The obtained results indicated that digestibility coefficients of DM, OM, CP, EE and NFE for lambs fed heat protected soybean meal protein were higher than those fed untreated diet. The improvements in nutrients digestibility reflected better feeding values in terms of TDN and DCP% for both diets contained treated protein than untreated one. Total dry matter intake varied between 1475.85 to 1518.28, 86.02 to 93.66 and 3.30 to 3.70 expressed as g/h/day, Kg W0.75 and %BW, respectively. In average, it is clearly appears that the highest daily weight gain was showed in T2 followed by T1 and control diets (0.211±0.013, 0.172±0.009 and 0.159±0.015Kg, respectively). The changes in body weights were in ascending order with increasing the level of protected soybean meal protein in animal diets. Net revenue was pronouncedly higher in diet that included heat protected soybean meal protein (853.634 and 1129.2 for T1 and T2, respectively) while it was 761.400L.E in control diet. From the obtained results, this study recommends the use of heat treatment as a protection method for SBM protein diets in growing lambs at 100% protected soybean meal protein.

Keywords: Rahmani lambs; Heat protected soybean meal; Nutrients digestibility; Feeding values; Growth performance.

INTRODUCTION

Protein is an important limiting nutrient in ruminant animals fed low quality forages. It becomes necessary when animal attains its optimum growth or peak production. This is because nutrient requirements of ruminants vary according to the physiological state like growth, lactation and pregnancy. The highest sources of crude protein is soybean meal (SBM) which considers the most commonly used protein supplement in dairy diets and beef. It is very palatable and has a good amino acid balance and high availability. Its bypass essential amino acid index is just next to ruminal microbial protein beating all other undegradable protein sources (Chandler, 1989). Due to the high cost of soybean meal protein supplements, means and ways of protecting the protein from degradation in the rumen whilst retaining the high digestibility is an urgent priority (Leng 1991). Several experiments have demonstrated the beneficial effects of the technological processing of feeds, particularly heat treatment, introduced by Manget (1997), in reducing the degradation of the crude protein in the rumen without decreasing digestibility in the small intestine. For high producing ruminants, heat treatment of protein supplements has been used for increasing the amount of dietary protein escaping rumen degradation, and to increase the amino acid pool entering the small intestine (Faldet *et al*., 1991). In addition, feeding bypass protein to ruminant had reducing dietary amino acid loss as urea and ammonia, energy conservation through less urea synthesis, efficient protein synthesis and improvement in reproductive efficiency (Tandon, 2008 and Kumar et al., 2015). Therefore, the objective of the present study is to investigate the effect of feeding different levels from heat protected soybean meal protein in diets of growing Rahmani lambs on their digestibility coefficients, feeding values and growth performance.

MATERIALS AND METHODS

The present study was carried out at Department of Animal Production, Faculty of Agriculture, Damietta University for 120 days feeding period during summer 2016. The animals were purchased from a local animal market of Blkas, Dakahlia governorate, Egypt. This study was performed out at private farm in Damietta governorate Egypt.

1. Experimental animals and tested materials:

Fifteen weaning Rahmani lambs with an average live body weight 19±0.5 kg and 4 months of age were randomly assigned into three groups (each of 5 lambs). The animals of each group were kept in a separate shaded pen. Animals were fed for 120 days and were fed in groups on the same three experimental diets which were as follows: Control (diet containing (SBM 15%) without treatment) as consists of concentrate feed mixture, CFM + Clover hay, CH. The T1 (diet containing 50% heat protected soybean meal + 50% soybean meal unprotected) as consists of CFM + CH and T2 (diet containing 100% heat protected soybean meal) as a consists of CFM + CH.

The experimental diets used in this study were contained a good quality roughage (CH 3rd cut) and concentrate feed mixture (CFM) to cover the nutrient requirement of DM and TDN which was adjusted according to average daily gain (ADG) and body weights (BW) according to the recommendation of **NRC (1985)**.

Animals were weighted at the beginning and thereafter at two-week intervals, and the amounts of diet were adjusted throughout the experimental period according of the BW changes. Fresh water was freely available to animals all the daytime. The tested diets were

fed twice daily at 08:00 and 16:00 h. and feed consumed was recorded daily. The formulation of the experimental concentrate feed mixture is shown in Table (1).

Table 1. Formulation of the three experimental concentrate feed mixtures

Ingredients (%)	Control	T1	T2
Soybean meal	15	7.5	-
Heated soybean meal	-	7.5	15
Maize grain	40	40	40
Wheat bran	25	25	25
Rice bran	17	17	17
Premix*	0.4	0.4	0.4
Sodium chloride	1.0	1.0	1.0
Limestone	1.6	1.6	1.6

***Premix contents per 3 kg are of vit. A. 12000000 IU, vit. D 3, 2200000 IU, vit. E, 10 gm, vit. K 3, 2 gm, copper, 10 gm, zinc, 50 gm, Manganese, 55 gm, Iodine, 1 gm, Selenium, 0.1 gm, Carrier (CaCo3), up to 3000 gm.**

2. Digestibility trials:

At the end of the feeding experiment, three digestibility trials were conducted using 3 animals from each tested group. The animals were kept individually during the collection period which lasted for a week. Feces were collected from the rectum daily in the morning before feeding. At the end of the collection period (on 3 lambs from each group for 7 days) representation samples (10% of fresh feces) were taken from each animal and dried at 60 °C for 48 hours. After drying, samples were ground to pass through a 0.5 mm screen and kept in a plastic container for chemical analysis. Representative samples of feeds and feces were analyzed according to A.O.A.C. (2012).

Digestibility coefficients of DM, OM, CP, CF, EE and NFE were determined using acid insoluble ash (AIA %) as natural marker according to Van keulen and Young (1977). The digestibility coefficient of certain nutrient (DCN) was calculated according to the following equation:-

$$DCN = 100 - \left(\frac{\text{AIA\% in feeds} \times \text{nutrient \% in feces}}{\text{AIA\% in feces} \times \text{nutrient \% infeeds}} \times 100\right)$$

The nutritive values presented as (TDN and DCP %) of the experimental rations were calculated according to the obtained digestibility coefficients.

TDN% = DCP + DCF + DNFE + DEE (2.25)

Digestible energy (DE), Metabolizable energy (ME) and Net energy (NE), were calculated according to MAFF (1975) as follows:

DE (MJ/kg DM) = digestable organic matter (g/kg) × 0.19.

(ME) was calculated as:

ME (MJ/kg DM) = 0.82 × DE (MJ/kg DM)

NE was calculated according to NRC (1989) as follows:

NE (MJ/kg DM) = 0.025 (TDN %) – 0.12 .

3. Heat treatment method:

The main source of protein in tested CFM in this study was SBM. The heat treatment method of SBM as protection of the high quality proteins from the degradation in the rumen was conducted according to Stern et al (1985). Soy bean meal was heated at 145°C in a forced air oven (POLIN VERONA ITALIA) for 4 hrs. SBM is placed in a 5 cm thick pan with stirring every hour. After the heating treatment, soybean meal was kept at room temperature (25°C for 3 hours before being mixed with other ingredients to formulate concentrate feed mixtures.

4. Economic efficiency:

The prices of the experimental diets were taking in the consideration the price fluctuations of all ingredients used throughout the complete feeding period, as well as manufacturing fees of diets. The following items were calculated:

Daily feed cost (LE) = Daily feed intake (kg) × Price of kg diet (LE).

Economic efficiency (%) = (A –B) /B × 100

where:

A = Price of ADG (LE), and B= Daily feed cost (LE).

5. Statistical analysis:

Data were statistically analyzed according to PROC ANOVA using computer program of statistical analysis system SAS, 2012 to test the effect of treatment on digestion coefficients, nutritional value and body weights were tested according to the following statistical model:

$$Y_{ij} = \mu + T_i + E_i.$$

Where, Y_{ij} is the individual observation of the parameter measured.
μ =is the overall mean.
T_i=the effect of treatment in each group.
E_i= the random error term.

Differences between means were tested for significance using multiple range tests according to Duncan (1955).

RESULTS AND DISCUSSION

1- Experimental diets:

The chemical composition of the ingredients and calculated chemical composition of tested diets (on DM basis, %) are presented in Table (2). The present results were in partial agreement with the findings of El-Shabrawy *et al.* (2010) who indicated that chemical composition of soybean meal was 93.20% OM, 42.48% CP, 3.40% EE, 6.21% CF, 41.11% NFE and 6.80% ash. The corn grain contained 98.10% OM, 9.11% CP, 2.35% EE, 2.70% CF, 83.94% NFE and 1.90% ash. Also, El-Shabrawy *et al.* (2004) indicated that chemical compositions of wheat bran contained 94.76% OM, 13.31% CP, 3.76% EE, 9.72% CF, 67.97% NFE and 5.24% ash. The chemical analyses of CH and CFM were within the normal published ranges by El-Ayek *et al.* (1999a), El-Shabrawy *et al.* (2010) and Gad, (2019). The CP, EE, CF, NFE and Ash contents in tested diets were practically similar and ranged from14.73 to 14.77, 3.56 to 3.61, 17.78 to 18.23, 52.96 to 53.12 and 10.52 to 10.72%, respectively. Such similarity in chemical composition of tested diets may be due to non differences in the formulation of the three tested diets ingredients (Table1). The calculated summative analyses of tested diets were in agreement with the statements of NRC (1985) recommendation for sheep as well as the three tested diets were formulated to be iso-nitrogenous iso-caloric.

2- Dry matter intake:

Result in Table (3) showed that total dry matter intake (TDMI) varied between 1475.85 to 1518.28, 86.02 to 93.66 and 3.30 to 3.70 expressed as g/h/day for Kg $W^{0.75}$ and %BW, respectively. TDMI expressed as g/h/d was practically similar in T1 and T2 group and both higher than in control one, while when expressed as Kg $W^{0.75}$ and % BW the values of T2 group were lower than those of T1

and control. The obtained values are in accordance with those of to (NRC, 1985). The present results agreed with Ruegsegger and Schultz (1985) and Tice *et al.* (1993) they reported that DMI was not affected by supplementation with heated-SBM versus untreated SBM in diets of sheep.

Table 2. The chemical composition on DM basis (%) of the ingredients and calculated tested diets.

Item	DM	Determined chemical composition, on DM basis (%)					
		OM	CP	EE	CF	NFE	Ash
Soybean meal	88.43	93.37	44.92	1.21	10.55	36.69	6.63
Maize grain	87.09	98.11	8.09	4.54	2.82	82.66	1.89
Wheat bran	88.11	94.01	14.20	3.43	10.08	66.30	5.99
Rice bran	89.42	91.62	12.86	17.26	4.77	56.73	8.38
CH	84.85	85.73	13.37	1.07	33.75	37.54	14.27
CFM	88.78	92.66	16.11	5.45	2.53	68.57	7.34
Calculated chemical composition of the tested diets							
Control	86.75	89.28	14.77	3.61	17.78	53.12	10.72
T1	86.75	89.28	14.77	3.61	17.78	53.12	10.72
T2	86.80	89.48	14.73	3.56	18.23	52.96	10.52

Control = Diet contained raw SBM, T1: Diet contained heat treated soy bean meal (SBM) 50%, T2: Diet contained heat treated soy bean meal (SBM) 100%.

Table 3.The average DM, TDN and DCP intake of tested diets as affected by heat protected SBM protein during digestion trials.

Items	Control	T1	T2
Average body weight (Kg)	40.39	41.04	45.96
Kg $W^{0.75}$	16.01	16.21	17.65
Intake of concentrate feed mixture (CFM):			
CFM g/h/day	754.63	754.63	754.63
Kg $W^{0.75}$	47.14	46.55	42.76
%BW	1.87	1.84	1.64
Intake of clover hay (CH):			
CH g/h/day	721.22	763.65	763.65
Kg $W^{0.75}$	45.05	47.11	43.27
% BW	1.79	1.86	1.66
Total DM intake:			
Total DM intake g/h/day	1475.85	1518.28	1518.28
Kg $W^{0.75}$	92.18	93.66	86.02
% BW	3.65	3.70	3.30
TDN intake:			
TDN intake g/h/day	911.33	936.78	955.23
TDN Kg $W^{0.75}$	56.92	57.79	56.39
% BW	2.26	2.28	2.08
DCP intake:			
DCP intake g/h/day	144.63	149.55	157.75
DCP Kg $W^{0.75}$	9.03	9.23	8.94
% BW	0.36	0.36	0.34

CFM= Concentrate feed mixer, CH= Clover Hay.

Moreover, Tiwari *et al.* (2013) in a study conducted on growing goats indicated that mean DMI increased significantly ($P<0.01$) as dietary CP level increased in different experimental diets but was not affected significantly ($P<0.05$) by heat treatment of Soybean cake being at range from 199.58, g to 207.6, g.

Regarding TDN intake as g/h/day and Kg $W^{0.75}$, it increased with increasing the level of protected soybean meal protein in tested diets, while as %BW the highest value was 2.28% and the lowest one was 2.08% with very small difference about 0.20%. Concerning DCP intake there were few changes among the three tested diets which ranged from 144.63 to 157.75, 8.94 to 9.23and 0.34 to 0.36 expressed as g/h/day, Kg $W^{0.75}$ and %BW, respectively.

Generally, TDN and DCP intake in the present study were in general agreement with those of NRC (1985) recommendation for the present weights for growing lambs. Also, the present results agreed with the findings of El-Ayek and Gabr (1994) they indicated that treated protein diet with formaldehyde improved both of TDN and DCP intake with sheep and goats. Also, El-Shabrawy *et al.* (2010) with Friesian calves and El-Shabrawy *et al.* (2012) with lactating cows came to same conclusion.

3- Digestibility coefficients and feeding values of the experimental diets:

Digestibility coefficients and feeding values of nutrients for tested diets are presented in Table (4). The only significant effect of two levels of protected SBM protein was showed on NFE digestibility but DM, OM, CP, EE and CF digestibility's were not significantly improved. The increased DM digestibility for tested diets was probably related to the stimulated greater rumination and total chewing activity that caused maximum cellulolytic bacteria activity and consequently better animal performance. It is clearly appears that T2 was higher for DM, OM, CP and EE than T1 and control diet with non significant differences. In contrast; T2 was lower for CF than T1 and control diet without significant differences among them. As for NFE, significant differences were observed among the three tested diets and T2 gave the highest value. The improvement in CP digestibility may be related to heat treatment as a protected protein, hence, reducing protein solubility and degradability in the rumen and therefore provided more dietary protein for digestion and absorption in the small intestine which is probably is better than microbial protein (Abdel-Ghani *et al*., 2011).The present results corresponded with Stern *et al.*, (1985) who found that heat treatment of SBM at 145^{o}C increased its flow to duodenum and increased nutrient digestibility in ruminant. In contrast; Baker *et al.* (1996) and Mabjeesh *et al.* (1997) found non significant difference in CP digestibility in dairy cows fed diets containing high rumen un-degradable protein (RUP) than those fed diets with low RUP.

In addition, the present results showed that protected protein by heat treatment increased the values of TDN and DCP compared with the control treatment. The improvement of TDN and DCP values may be due to enhanced digestibility coefficient of nutrients in response to the protected protein by heat treatment. Similar results were reported by El-Reweny (1999 & 2006) and Abdel-Ghani *et al*. (2011) they indicated that the values of TDN were significantly higher in sheep fed diet supplemented with protected protein in concentrate feed mixture. Moreover, El-Shabrawy *et al.* (2010) reported that protected protein of soybean meal by zinc sulphate significantly affected TDN% and DCP%, being at range from 64.48 to 68.97% and from 9.94 to 10.76%, respectively. It was clear that, diets containing 100% protected soybean meal had the highest value of digested energy (13.70 MJ/kg DM). Meanwhile, the control diet

and diet with 50% protected soybean meal had the same value of DE. Also, the value of ME and NE took the same direction like that showed with DE.

Table 4. The digestibility coefficients and feeding values of tested diets as affected by heat protected SBM protein.

Items (%)	control	T1	T2	P-Value
Nutrient digestibility (%):				
DM	69.25±0.44	69.90±0.59	70.64±0.34	0.188
OM	69.16±0.15	69.23±0.11	72.10±1.53	0.097
CP	66.38±0.75	66.71±1.31	70.51±1.32	0.081
EE	84.43±0.51	85.77±0.94	86.21±0.84	0.316
CF	66.88±3.74	66.61±2.24	65.87±1.19	0.958
NFE	69.67±1.21^{b}	69.69±0.54^{b}	76.03±0.25^{a}	0.001
Feeding values:				
TDN%	61.75±0.28^{b}	61.70±0.49^{b}	65.55±0.40^{a}	0.0007
DCP%	9.80±0.11	9.85±0.19	10.39±0.20	0.095
DE (MJ/kg DM)	13.14±0.03	13.15±0.02	13.70±0.29	0.097
ME (MJ/kgDM)	10.78±0.024	10.79±0.02	11.23±0.24	0.097
NE (MJ/kg DM)	1.42±0.007^{b}	1.42±0.01^{b}	1.52±0.01^{a}	0.0007

Note: Values marked in different superscripts in the same row were significantly different (P≤0.05)

a and b; Means with different superscripts within each row for each parameter

Digestible energy (DE) and Metabolizable energy (ME), were calculated according to MAFF (1975) as follows:

DE (MJ/kg DM) = digestable organic matter (g/kg) × 0.19.

ME (MJ/kg DM) = 0.82 × DE (MJ/kg DM)

Net energy was calculated according to NRC (1989) as follows:

NE (MJ/kg DM) = 0.025 (TDN %) – 0.12.

4- Growth performance:

Results in Tables (5) clearly indicated that the elevated protected soybean meal levels had significant influence on all body weight estimates of growing lambs except initial body weight. In average, it is clearly appears that the highest daily weight gain was showed in group fed T2 followed by the group fed T1 and then group fed control diet (0.223±0.013, 0.183±0.009 and 0.168±0.015g, respectively).

The changes in body weights were in ascending order with increasing the levels of heat protected soybean meal in animal diets. Moreover, the group fed T2 was highest in average daily gain compared with those fed T1 and control group. The present results reflect the positive effect and beneficial effect of dietary protein utilization of these tested diets compared with control one. Such results are accordance with the statements of El-Ayek *et al.* (1999 a and b) and El-Shabrawy *et al.* (2010) they indicated that protein protection of SBM improved body weight gain in growing lambs.

The present results corresponded with the findings of several authors (Abdel-Ghani *et al.*, 2011; Osti *et al*., 2013; Kumar *et al*., 2015) they observed significant effects of protein protection meal on average body weight gain in studies conducted on growing lambs and cattle. Furthermore, Chunjian and Limin (2016) indicated that the using of heat protected soybean meal resulted in significant improve in growth rate. In contrast, Sahlu *et al.* (2012) showed non significant differences (P > 0.05) in body weight gain between different treatments with and without heat protected soybean meal in angora goats.

Table 5. Changes in live body weight and averge daily gain (ADG) growing sheep during the whole experimental period (120 day)

Wight (Kg)	Control	T1	T2	P-Value
W13-14	20.17±0.37	19.09±0.29	19.10±0.39	0.082
W15-16	21.56±0.58	20.36±0.44	21.18±0.26	0.215
W17-18	23.68±0.64^{a}	21.80±0.50^{b}	23.53±0.25^{a}	0.046
W19-20	25.18±0.66^{ab}	23.88±0.56^{b}	25.82±0.32^{a}	0.050
W21-22	27.71±1.08^{ab}	26.50±0.73^{b}	29.67±0.28^{a}	0.050
W23-24	30.34±1.44	30.09±0.87	33.02±0.72	0.184
W25-26	33.95±1.43	33.09±1.08	36.88±1.02	0.132
W27-28	37.02±1.40^{ab}	36.31±1.09^{b}	40.50±1.09^{a}	0.050
W29-30	39.37±1.77^{b}	39.37±1.01^{b}	44.45±1.47^{a}	0.040
W31	40.39±1.91^{b}	41.04±1.17^{b}	45.96±1.46^{a}	0.051
ADG	0.168±0.015^{b}	0.183±0.009^{ab}	0.223±0.013^{a}	0.049

Note: Values marked in different superscripts in the same row were significantly different (P≤0.05)

a and b; Means with different superscripts within each row for each parameter

W: week, kg: kilogram.

5- Economic efficiency:

Results in Table (6) showed that feed conversion rate (FCR) was lower (the best) in T2 and T1 than that of control group and such effect could be attributed with higher ADG in group T2 and T1 (223 and 183 g/h/d respectively) than of control one (168 g/h/d). Economic efficiency of dietary treatments cleared that, net revenue was pronouncedly higher in diet that included protected soybean meal (853.634 and 1129.2 L.E for T1 and T2, respectively) than control diet (761.400 L.E). The high improvement in economic efficiency for diets contained protected soybean meal (2.842 and 3.340 for T1 and T2, respectively) could be related to the high conversion ratio as well as the positive influence on feeding value. It is of interest to observe that feed cost was the highest with T2 while, the control showed the lowest one. The net revenue was pronouncedly higher with T2 that including soybean meal heat treatment.

Table 6. The economic efficiency as affected by heat protected SBM protein.

Items	control	T1	T2
Initial weight, (Kg)	20.17	19.09	19.10
Final weight, (Kg)	40.39	41.04	45.96
Total gain, (Kg)	20.22	21.95	26.86
Daily gain, (g)	168	183	223
Average DMI (g) from:			
CFM as fed	650	650	650
CFM as DM bases	577.07	577.07	577.07
CH as fed	650	644.44	700
CH as DM bases	551.53	546.81	593.95
Total DMI as fed	1300	1294.44	1350
Total DMI as DM bases	1128.59	1123.88	1171.02
Feed conversion ratio g DM/g gain	6.72	6.14	5.25
Out put, (L.E)	1213,600	1317	1611.600
In put feed concentrate, (L.E)	366.600	378.300	390.000
In put feed Clover Hay, (L.E)	85.800	85.066	92.400
Total in put feed, (L.E)	452.400	463.366	482.400
Net revenue, (L.E)1	761.200	853.634	1129.200
Economic efficiency2	2.683	2.842	3.340

Price of feed stuffs: 4,70 L.E/ Kg of concentrate feed mixture(CFM) with control feed, 4,85 L.E/ Kg of concentrate feed mixture(CFM) with T1 feed, 5.00 L.E/ Kg of concentrate feed mixture(CFM) with T2 feed, 1.10 L.E/ Kg of Clover Hay chopped and 60 L.E/ Kg of meat according to the prices of year 2016 in Egypt.

[1]Net revenue (L.E) = money output – money input. [2]Economic efficiency= money output / money input.

The present results agreed with El-Shabrawy *et al.* (2010) who observed that protected cottonseed meal by zink sulphate resulted in decrease in feed costs and increase in economic efficiency in Friesian calves diets. On the same line, El-Hosseiny *et al.* (2000) reported that the utilization of tannin protected sunflower or chamomile flowers supported the farmer's income through produce more milk per animal. Therefore, the economic efficiency improved and the net revenue increased as well. In addition, Abo El-Fadel and Ashmawy (2015) observed that the protected linseed meal and cotton seed meal at 2% resulted in better economic evaluation expressed as economic return. Recently, Hussein *et al.* (2018) reported that feed cost was higher in diet contained untreated Sunflower meal than that contained protected Sunflower meal by Tannin.

CONCLUSION

On the light of above results, using of heat treatment as a tool for protecting soybean meal protein from degradation in the rumen of growing lambs at the two replacing levels (50 and 100% of untreated SBM protein) had a beneficial effect on their growth performance, nutrients digestibility, feeding values and economic efficiency indicating better utilization of the treated diets, without having any negative effect on all parameters studied.

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تأثير التغذية على مستويات مختلفة من بروتين كسب فول الصويا المحمي بالحرارة فى علائق الحملان الرحمانى النامية على معاملات الهضم والقيمة الغذائية والأداء الانتاجى.

محمود يوسف العايق [1] ، مصطفى ماهر المغازى [2] وحمادة عنتر عريضة[2]

[1]قسم إنتاج الحيوان ، كلية الزراعة ، جامعة المنصورة ، مصر

[2]قسم إنتاج الحيوان ، كلية الزراعة ، جامعة دمياط ، مصر

أجريت هذه الدراسة على خمسة عشر حمل رحمانى نامي (بعد الفطام) بمتوسط وزن 0.5±19كجم وعمر اربعة أشهر تقريباً وزعوا بشكل عشوائى فى ثلاثة مجموعات تجريبية (5 حملان بكل مجموعة) بهدف دراسة تأثير التغذية على مستويات مختلفة من بروتين كسب فول الصويا المحمى بالحرارة على درجة 145°م لمدة 4ساعات فى فرن الهوا الساخن على معاملات هضم المواد الغذائية والقيمة الغذائية وانعكاسها على أداء النمو فى الحملان النامية. تم تغذية الحيوانات لمدة 120 يوم فى تجربة تغذية على العلائق الغذائية التجريبية الثلاثة. مجموعة الكنترول غذيت على عليقة تحتوى على كسب فول الصويا غير معامل (بنسبة 15%) ضمن مكونات العلف المركز+ دريس البرسيم. المجموعة الاولى (T1) غذيت على عليقة تحتوى على 50% كسب فول الصويا معامل بالحرارة + 50% كسب فول الصويا غير معامل بالحرارة من نسبة كسب فول الصويا بالعلف المركز + دريس البرسيم والمجموعة الثانية (T2) غذيت على عليقة تحتوى على 100% كسب فول الصويا معامل بالحرارة من نسبة كسب فول الصويا بالعلف المركز + دريس البرسيم. تم تقدير معاملات الهضم بطريقة المرقم الطبيعى باستخدام الرماد غير الذائب فى الاحماض. أظهرت النتائج التى تم الحصول عليها أن معاملات هضم المادة الجافة والمادة العضوية والبروتين الخام والمستخلص الاثيرى والمستخلص خالى الازوت للحملان كانت مرتفعة فى الحملان التى غذيت على بروتين كسب فول صويا محمى بالحرارة مقارنة بالحملان المغذاه على العليقة الكنترول.التحسن فى معاملات هضم المواد الغذائية يعكس ارتفاع القيم الغذائية من حيث TDN و DCP فى العلائق المحتوية على البروتين المحمى مقارنة بالعلائق الغير محتوية على بروتين محمى. كانت كمية المادة الجافة المأكولة الكلية تتراوح من 1475.85 الى 1518.82 جم/ للرأس/ يوم ومن 86.02 الى 93.66 ومن3.30 الى 3.70 لوزن الجسم التمثيلى و%BW على التوالى. سجلت اعلى زيادة فى معدل النمو اليومى فى(T2) متبوعة بالمجموعة (T1) ثم يليها مجموعة الكنترول(0.013± 0.211 و0.009±0.172 و0.015±159 جم على التوالى). كانت التغيرات فى وزن الجسم فى ترتيب تصاعدى مع زيادة نسبة بروتين كسب فول الصويا المحمى فى العلائق التجريبية. كان صافى الايرادات أعلى بشكل واضح فى العلائق المحتوية على بروتين كسب فول صويا محمى بالحرارة(853.634 و 1129 لكلا من T1 وT2 على التوالى) مقارنة بالعليقة الكنترول (761.400) جنيه مصرى. من النتائج سالفة الذكر توصى الدراسة باستخدام المعاملة الحرارية لحماية بروتين كسب فول الصويا عند مستوى 50% و 100% إحلال بروتين فول الصويا غير المعامل فى علائق الحملان النامية حيث أدى لتحسن الأداء الانتاجى للحملان النامية وزيادة المردود الاقتصادى لها.