EFFECT OF DIFFERENT PROTEIN LEVELS ON GROWTH PERFORMANCE, CARCASS TRAIT, DIGESTIBILITY AND SOME BLOOD BIOCHEMICAL PARAMETERS IN AWASSI LAMBS

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ABSTRACT

Twenty one Awassi lambs (4 month old and 23.59 ± 0.31 kg body weight) were used to investigate the effect of different levels of protein on growth, carcass traits, body composition, digestibility and some blood parameters. The lambs were divided equally and randomly and penned individually into three treatment groups, and fed ad lib on low protein (129.1 T1) medium protein (140.6 T2) and high protein (151.1 T3, g/kg DM). After 72 days of fattening, 5 lambs from each treatment were chosen randomly and slaughtered. The result showed that lambs fed on T3 diet had significantly (P<0.05) higher daily gain (210.83 g), better feed efficiency (4.8 kg/kg), higher dressing percentage (51.67 %), and rib eye area muscle (12.05 cm2) than those fed in T2 and T3, as well as digestibility coefficient of dry matter, organic matter, crude protein, and total digestible nutrient (TDN) was also numerically higher in group fed (151.1 g/kg DM) as compared with lambs received low or medium level of protein. It could be concluded that the high dietary protein level produce the better performance, carcass traits and nutrient digestion of lambs.

Keywords: protein, growth, trait, lambs, body composition, organic matter.

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INTRODUCTION
Animal meat production efficiency can be defined as the return of salable product per unit feed input (5). In the Middle East including Iraq, 80% of the production cost of red meat from fattening lambs is attributed to feed cost (11). It is known that a number of factors affect growth performance, the quality and quantity of the carcass, as well as productivity in sheep farming, which dietary energy and protein levels and their interaction are probably considered the most important (10). Also, the amount of tissue deposited in the carcass components is largely determined by the level of protein intake and the energy available for retention in muscle (4). Studies were conducted to determine the optimum dietary crude protein (CP) level for lambs. The NRC (23) recommended 14.5% CP for weaned lambs for maximum growth rate, but Andrews and Orskov (1) indicated that maximum weight gain occurred at 17 % dietary CP. Although feeding lambs with 18% CP diet is common practice, it was observed that lambs feed 16 and 18 % CP diet had higher body weight gain and dry matter intake than lambs fed 10, 12 and 14 % CP diet, and there were no difference between lambs fed 16 and 18 % CP (10). Since the increasing cost of protein and environmental pollution due to emission of ammonia into the atmosphere from degradation of urea in extra demands the determination of optimum levels of dietary protein for animal to avoid unnecessary loss of nitrogen, optimize production and minimize costs of feed and risk of environmental pollution. Therefore the aim of this study was to investigate the effect of different dietary crude protein levels on performance, digestibility and some biochemical parameters of Awassi lambs.

MATERIALS AND METHODS
The present study was carried out at animal farm, College of Agricultural Engineering Sciences, University of Duhok, where 21 weaned Awassi ram lambs (4 month) with an average live body weight of 23.59± 0.31 kg were used. After an adaptation period of 10 days, the lambs were randomly and equally allocated and individually penned (1 ×2 m) into three treatment groups to receive ad libitum concentrate containing different level of crude protein namely 129.1 (T1), 140.6 (T2) and 151.1 (T3) g/kg/DM (Table 1). The offered concentrate was weighed daily, and the refusal was collected and weighed before morning feeding. Clean water was available constantly.

Table1. Ingredient and chemical composition of the diet

| Ingredient | % | T1 | T2 | T3 |
|------------|---|----|----|----|
| Barley     |   | 60 | 57 | 53 |
| Corn       |   | 17 | 17 | 17 |
| Wheat bran |   | 8  | 8  | 8  |
| Wheat straw|   | 3  | 3  | 3  |
| Soybean meal| | 7  | 10 | 14 |
| Urea       |   | 0.15 | 0.15 | 0.1 |
| Oil        |   | 2.85 | 2.85 | 2.9 |
| Salt       |   | 1  | 1  | 1  |
| Mineral & Vitamin | | 0.5 | 0.5 | 0.5 |
| Limestone  |   | 0.5 | 0.5 | 0.5 |
| Total      |   | 100 | 100 | 100 |

Chemical composition g/kg DM

| Component          | Value   |
|--------------------|---------|
| Dry matter         | 911     |
| Organic matter     | 975     |
| Ash                | 25      |
| Crude protein      | 129.1   |
| Ether Extract      | 41      |
| Crude fiber        | 62.4    |
| Nitrogen Free Extract | 653.5 |
| Metabolizable Energy | 12.26 |

T1= Treatment 1 (Low protein)
T2= Treatment 2 (Medium protein)
T3= Treatment 3 (High protein)

Chemical composition = (AOAC, 2007)
NFE = 1000 - (water + Ash + CP + EE + CF).
ME = (CP*0.012) + (EE*0.031) + (CF*0.005) + (NFE*0.014)

Following 72 days of fattening, five lambs from each group were chosen randomly and slaughtered. Feed was withdrawal over night and lambs were slaughtered according to muslim (Halal) way by severing the throat and major blood vessels in the neck. Immediately after skinning was completed, non- carcass components such as head, skin, feet, liver, spleen, heart, lung with trachea and testes were weighed. Dressed carcass was weighed within 1 h. The gastro- intestinal tract was weighed, and then emptied of their content, washed and re-weighted to facilitate calculation of empty body weight by subtracting the weight of gut content from slaughter weight. Also weight of...
including subcutaneous and intramuscular fat was recorded.

**Carcass measurements**

After chilling the carcass at 4°C for 24h, cold carcass was weighed and kidney and pelvic fat was weighed separately. The carcass was split along the vertebral column into two halves, using an electrical saw. The right half was separated into eight whole sale cuts. The cross-sectional area of L.dorsi muscle between 12 and 13 ribs was traced of the cutting and the area was subsequently measured by digital planimeter. Fat thickness over the midpoint of L. dorsi muscle was measured by using Caliper device.

**Physical dissection**

All whole cuts of the right half carcass were dissected completely into lean, fat and bone. The three components were weighed separately to determine their percentage. Non-carcass fat is the sum of the omental, mesenteric, pelvic, kidney and cardiac fat. Carcass fat including subcutaneous and intramuscular fat was separated from each cut and weighed.

**Apparent digestibility**

To measure digestibility, 3 lambs from each group were placed in individual pens (1x2 m) at the end of last week of experiment. Total fecal output was determined for 7-days. Feces from each animal were weighed daily and a sample (10%) was taken and frozen, and later was analyzed according to AOAC (2).

### Table 2. Effect of different protein level on animal performance

| Trait                | Over all mean | T<sub>1</sub> | T<sub>2</sub> | T<sub>3</sub> |
|----------------------|---------------|---------------|---------------|---------------|
| Trait                | Low protein g/kg DM | Medium protein g/kg DM | High protein g/kg DM |
| Initial wt./ kg      | 23.59 ± 0.31   | 23.66 ± 0.59  | 23.50 ± 0.59  | 23.62 ± 0.56  |
| Final Wt./ kg        | 35.87 ± 0.89   | 32.12 ± 0.40  | 36.70 ± 1.12  | 38.80 ± 1.03  |
| Total gain/ kg       | 12.28 ± 0.87   | 8.46 ± 0.95   | 13.20 ± 0.88  | 15.18 ± 0.60  |
| Daily gain/ g        | 170.55 ± 12.13 | 117.50 ± 13.28| 183.33 ± 12.22| 210.83 ± 8.44|
| Total DM/kg          | 61.19 ± 2.00   | 58.19 ± 1.24  | 61.87 ± 5.39  | 63.51 ± 2.77  |
| FCR kg/kg            | 5.41 ± 0.47    | 7.23 ± 0.79   | 4.81 ± 0.62   | 4.18 ± 0.08   |

**Carcass traits**

In the present study, results related to carcass traits of feeding Awassi lambs under three different protein levels are summarized in Table 3. It appears that lambs received high protein level had significantly (P≤0.05) heaviest slaughter weight (38.80 Kg), carcass weight (20.02 kg), dressing percentage based on slaughter weight (51.67 kg) and empty body weight (57.11 kg) than those fed low (T<sub>1</sub>) and medium (T<sub>2</sub>) protein levels. Such increase could be due to higher growth rate attained by lambs maintained on high level of protein as a result of lambs responding well to the level of crude protein. Or such result could be attributed to higher slaughter weight (19) as a result of higher muscle mass (16), which contribute to observed gain in lean mass (32). Similar finding was noticed in sheep (33), in goat (6), and in cattle (9 and 18).

### Statistical analyses

The experiment was designed by complete randomized design CRD. Data was analyzed statistically using general linear model procedures within SAS (30). Duncan (8) multiple range test was used to test differences between treatments.

**RESULTS AND DISCUSSION**

**Growth performance**

Data related to growth performance in term of initial, final and daily gain in weight of Awassi lambs maintained on three different protein levels are demonstrated (Table 2). It appears that lambs fed high levels of protein (T<sub>3</sub>) had significantly (P≤0.05) highest in weight gain (210.83 g), more dry matter intake (882.06 g) and better (P≤0.05) efficient of feed conversion (4.18) than lamb fed low (T<sub>1</sub>) and medium (T<sub>2</sub>) protein level. Such increases in body gain could be due to the animals deposit more protein in their body during early growth, which indicates that they can utilize rations with higher protein levels (26). Increased efficiency of FCR was a result of increased intake above maintenance and possibly increased organic matter digestibility (22). Or may be this result is due to the highest bioavailability of nutrient by balanced energy and protein levels on the treatments (13). This finding is in accordance with those reported in sheep (10, 29), as well as in goat (2, 22, 13, 27).
The proportion of separable tissue is very important in meat animal (7, 13, 20, 24, 28).

Table 3. Effect of different protein level on carcass and non-carcass fat

| Trait                      | Over all mean | T1: Low protein | T2: Medium protein | T3: High protein |
|----------------------------|---------------|-----------------|--------------------|-----------------|
|                            |               | 129.1 g/kg DM   | 140.6 g/kg DM      | 151.1 g/kg DM   |
| Slaughter weight/ kg       | 35.87 ± 0.89  | 32.12 ± 0.40    | 36.70 ± 1.12       | 38.80 ± 1.03    |
| Hot carcass weight kg      | 17.50 ± 0.58  | 15.02 ± 0.38    | 17.46 ± 0.45       | 20.02 ± 0.37    |
| Cold carcass weight kg     | 17.29 ± 0.57  | 14.85 ± 0.39    | 17.27 ± 0.47       | 19.76 ± 0.30    |
| Shrinkage percentage       | 1.18 ± 0.13   | 1.16 ± 0.12     | 1.10 ± 0.27        | 1.29 ± 0.29     |
| Dressing % (slaughter wt.)| 48.68 ± 0.68  | 46.76 ± 0.75    | 47.61 ± 0.43       | 51.67 ± 0.87    |
| Dressing % (EBW wt.)      | 53.68 ± 0.74  | 51.48 ± 0.62    | 52.44 ± 0.51       | 57.11 ± 0.74    |
| Rib eye area cm²           | 10.60 ± 0.38  | 9.05 ± 0.43     | 10.71 ± 0.32       | 12.05 ± 0.33    |
| Fat thickness mm           | 0.15 ± 0.007  | 0.14 ± 0.01     | 0.14 ± 0.01        | 0.17 ± 0.003    |

Values of a,b,c on the same row with different letters are significant different (P≤0.05).

Carcass composition

Carcass side of Awassi lambs fed diet of different protein levels are demonstrates in Table 4. The proportion of separable tissue indicates that lambs fed high protein levels in T3 are numerically leaner and fatter compared to those fed low or medium level of protein. Moreover, the higher ratio of lean to fat and lean to bone was also recorded in T3 compared with T2 and T1. These results agree with those found in sheep and goats (7, 13, 20). The proportional contribution of fat to the total body fat was very little and statistically did not significant.

Table 4. Effect of different protein level on carcass composition

| Trait                      | Over all mean | T1: Low protein | T2: Medium protein | T3: High protein |
|----------------------------|---------------|-----------------|--------------------|-----------------|
|                            |               | 129.1 g/kg DM   | 140.6 g/kg DM      | 151.1 g/kg DM   |
| Lean                       | 57.48 ± 0.77  | 56.94 ± 0.65    | 57.65 ± 1.29       | 57.85 ± 2.03    |
| Fat                        | 20.72 ± 0.95  | 20.16 ± 1.41    | 20.92 ± 1.55       | 21.07 ± 2.23    |
| Bone                       | 21.82 ± 0.54  | 22.88 ± 1.07    | 21.41 ± 0.98       | 21.18 ± 0.77    |
| Lean : fat ratio           | 2.88 ± 0.16   | 2.87 ± 0.19     | 2.84 ± 0.28        | 2.93 ± 0.42     |
| Lean : bone ratio          | 2.66 ± 0.07   | 2.53 ± 0.08     | 2.71 ± 0.14        | 2.74 ± 0.13     |

Values of a,b,c on the same row with different letters are significant different (P≤0.05).

Carcass and non-carcass fat

One of the most variable tissues in the carcass is the Wt. carcass fat, the proportion and location of fat in the body are important in meat animal (34). Data related to the total fat, weight of carcass fat and weight of non-carcass fat are shown in Table 5. It appear that the amount of the fat deposited in the lambs fed high protein level in (T3) is higher (1.58 kg) than other two groups fed medium (1.47 kg) or low (1.21 kg), while the relative contribution of carcass and non-carcass fat to the total body fat was very little and statistically did not significant.

Table 5. Effect of different protein level on carcass and non- carcass fat

| Trait                      | Over all mean | T1: Low protein | T2: Medium protein | T3: High protein |
|----------------------------|---------------|-----------------|--------------------|-----------------|
|                            |               | 129.1 g/kg DM   | 140.6 g/kg DM      | 151.1 g/kg DM   |
| Wt. carcass fat/ kg        | 1.42 ± 0.09   | 1.21 ± 0.09     | 1.47 ± 0.14        | 1.58 ± 0.19     |
| Wt. non- carcass fat/ kg   | 0.91 ± 0.04   | 0.79 ± 0.02     | 0.95± 0.09         | 0.99 ± 0.05     |
| Wt. fat tail/ kg           | 2.32 ± 0.15   | 1.97 ± 0.04     | 2.41 ± 0.31        | 2.58 ± 0.31     |
| Total body fat/ kg         | 4.65 ± 0.24   | 3.97 ± 0.11     | 4.84 ± 0.43        | 5.14 ± 0.48     |
| Non- carcass fat %         | 19.92 ± 0.91  | 19.96 ± 0.95    | 19.85 ± 1.67       | 19.96 ± 2.24    |
| Carcass fat %              | 30.39 ± 1.03  | 30.24 ± 1.59    | 30.53 ± 1.80       | 30.39 ± 2.33    |
| Fat tail %                 | 49.68 ± 1.20  | 49.79 ± 0.83    | 49.61 ± 3.28       | 49.64 ± 1.94    |

Apparent digestibility

It seems from the results show in Table 6, that dry matter digestibility (74.58, 79.76 and 79.56 %), organic matter digestibility (78.33, 82.21 and 82.14 %) and crude protein digestibility (62.47, 68.99 and 70.74 %) of the three dietary crude protein levels in T1, T2 and T3 respectively, were not different significantly, but their values was increased by increasing protein levels. The higher crude protein digestibility for the lambs that fed 151g/kg DM in T3 could be attributed to the highest CP level resulted in an increase the population growth and total activity of rumen.
microbes and fermentation (31). These results agree with those found by other workers (6, 14, 25). Similarly total digestible nutrient (TDN) of T1, T2 and T3 averaged respectively 72.24, 75.59 and 75.47 %, and the differences among them did not significant. Also it was noticed that the effect of level of protein on the apparent digestibility of fiber as well as either extract lacked significance. Similar result was obtained by other investigation (3, 25).

| Table 6. Effect of different protein level on apparent digestibility |
|---------------------------------------------------------------|
| Digestibility Coefficient % | T1 Low protein 129.1 g/kg DM | T2 Medium protein 140.6 g/kg DM | T3 High protein 151.1 g/kg DM |
| Dry matter | 77.97 ± 2.14 | 74.58 ± 2.05 | 79.76 ± 4.25 | 79.57 ± 4.92 |
| Organic matter | 80.89 ± 1.74 | 78.33 ± 1.59 | 82.21 ± 3.54 | 82.14 ± 4.05 |
| Crude protein | 67.40 ± 3.35 | 62.47 ± 2.91 | 68.99 ± 6.82 | 70.74 ± 7.80 |
| Crude fiber | 30.61 ± 3.20 | 32.19 ± 5.75 | 29.72 ± 4.43 | 29.91 ± 8.27 |
| Ether extract | 68.41 ± 1.91 | 67.89 ± 1.52 | 68.87 ± 3.75 | 68.45 ± 5.23 |
| Nitrogen free extract | 88.45 ± 1.54 | 85.54 ± 1.06 | 89.97 ± 3.57 | 89.85 ± 2.90 |
| TDN | 74.43 ± 1.63 | 72.24 ± 1.53 | 75.59 ± 3.27 | 75.47 ± 3.91 |

Values of a, b, c on the same row with different letters are significant different (P≤0.05)

Blood parameters
The results related to concentrations of serum biochemical (glucose, total protein, albumin, globulin, cholesterol, triglyceride and urea) of Awassi lambs fed three different protein levels are shows in Table 7. It seems that no significant effects was observed in all parameters. However, blood urea increased by increasing protein level but the increase was not significant. Similar results have been reported by other researchers (12, 15, 21, 29, 34, 35).

| Table 7. Effect of different protein level on blood parameters |
|---------------------------------------------------------------|
| Items | T1 Low protein 129.1 g/kg DM | T2 Medium protein 140.6 g/kg DM | T3 High protein 151.1 g/kg DM |
| Glucose mg/dl | 66.00 ± 1.65 | 65.00 ± 3.01 | 66.40 ± 2.82 | 66.60 ± 3.37 |
| Total protein g/dl | 5.74 ± 0.12 | 5.82 ± 0.21 | 5.66 ± 0.14 | 5.76 ± 0.28 |
| Albumin g/dl | 2.38 ± 0.07 | 2.38 ± 0.12 | 2.30 ± 0.11 | 2.48 ± 0.15 |
| Globulin g/dl | 3.36 ± 0.15 | 3.44 ± 0.32 | 3.36 ± 0.05 | 3.28 ± 0.38 |
| Cholesterol mg/dl | 58.33 ± 2.35 | 57.00 ± 3.72 | 59.40 ± 5.64 | 58.60 ± 3.41 |
| Triglyceride mg/dl | 34.40 ± 2.63 | 33.80 ± 3.72 | 34.60 ± 2.46 | 34.80 ± 7.27 |
| Urea mg/dl | 14.33 ± 0.73 | 12.80 ± 0.48 | 14.80 ± 1.68 | 15.40 ± 1.288 |

CONCLUSION
It could be concluded that Awassi lambs can be finished on diet containing 151.1 g/kg DM to achieve better performance, carcass traits and digestion of nutrient.

REFERENCES
1. Andrews, R.P. and E.R. Orskow 1970. The nutrition of the early weaned lamb, Journal of Agric Science Camb, 75: 8-11
2. AOAC 2007. Official Methods of Analysis. Association of Official Analytical Chemists, Arlington, VA
3. Atti, N., H. Rouissi and M. Mahouachi 2004. The effect of dietary crude protein level on growth, carcass and meat composition of male goat kids in Tunisia. Small Ruminant Research 54: 89-97
4. Baracos, V.E. 2005. Whole Animal And Tissue Proteolysis. In: Biology Of Metabolism In Growing Animals III (Ed. D. G. Burrin and H. J. Mersmann). Elsevier Ltd. Oxford, UK. pp. 69-82
5. Beermann, D.H., D.E.Hogue, V.K. Fishell, R.H.Dalrymple and C.A. Ricks 1986. Effects of cimaterol and fishmeal on performance, carcass characteristics and skeletal muscle growth in lambs. J. Anim. Sci. 62: 370-380
6. Chobtang, J., K. Intharak and A. Isuwan 2009. Effects of dietary crude protein levels on nutrient digestibility and growth performance of Thai indigenous male goats. Songklanakarin J.Sci. Technol 31(6): 591-596
7. Dabiri, N. 2016. Effects of different dietary energy and protein levels at fixed slaughter weight on performance and carcass characteristics of arabi fattening lambs. J. of Fisheries Livest Production. 4(4): 1-4
8. Duncan, C.B. (1955). Multiple Range and Multiple F test. Biometric 11: 1-12
9. Fiems, L.O., S. de Campeneere, D. F. Bogaerts, B. G. Cottyn and Ch. V. Bouque 1998. The influence of dietary energy and protein levels on performance, carcass and meat quality of Belgian White-blue double-muscled finishing bulls. Animal Science 66: 319-327
10. Haddad, S.G., R.E. Nasr and M.M. Muwalla 2001. Optimum dietary crude protein level for finishing Awassi lambs. Small Ruminant Research 39: 41-46
11. Harb, M. and M.S. Habbab 1989. The economics and the management problems of sheep fattening in Jordan. Dirassat 16: 52-69
12. Hassan, S. A. and A. A. Saeed 2015. Effect of feeding different levels of dietary protein and addition of baker’s yeast (Saccharomyces cerevisiae) on Awassi lambs performance. 3-Blood parameters. Kufa Journal for Agricultural Science 7(1): 237-257
13. Hwangbo, S., S. Ho Choi, S. Woo Kim, D. Soo Son, H. Sung Park, S. Hoon Lee and I. Hwan Jo. 2009. Effects of crude protein levels in total mixed rations on growth performance and meat quality in growing korean black goats. Asian Australas. J. of Animal Science.22 (8):1133-1139
14. Kaya, I. Y. Unal, T. Sahin and D. Elmali 2009. Effect of different protein levels on fattening performance, digestibility and Rumen parameters in finishing lambs. Journal of Animal and Veterinary Advance 8(2): 309-312
15. Keser, O. and T. Bilal 2008. Effect of different dietary crude protein levels on performance, n digestibility and some blood parameters in kivircik lambs. Acta Veterinaria (Beograd) 58:487-498
16. Luginbuhl, J. M. 1998. Breed and production traits of meat goats. North Carolina Cooperative Extension Service, North Carolina State University, College of Agricultural and Life Sciences Publication Number ANS 00-603 MG. the American Kiko Goat Association
17. MAFF 1975. Energy Allowances and Feeding Systems for Ruminants. Technical Bulletin
18. Magee, W.T., R.H. Nelson, G.A. Branaman and L.J. Bratzler 1958. Some Factors affecting carcass grade in steers. Journal of Animal Science. 17: 649-655
19. Marinova, P., V. Banskalieva, S. Alexandrov, V. Tzvetkova and H. Stanchev 2001. Carcass composition and meat quality of kids fed sunflower oil supplemented diet. Small Ruminant Research 42: 217-225
20. Matenga, L.A. and A.J. Kitaly 1990. Growth performance and carcass characteristics of Tanzanian goats fed chloris gayana hay with different levels of protein supplement. Small Ruminant Research 3: 1-8
21. Muruz, H., I. Kaya, N. Cetinkaya, M. Salman and E. Atmaca 2017. The effects of diets with different protein contents on growth performance and digestibility, and on some ruminal fermentation and blood parameters, in Bafra Lambs. Kafkas Univ Vet Fak Derg 23(6): 939-946
22. Negesse, T., M. Rodehutscord and E. Pfeffer. 2001. The effect of dietary crude protein level on intake, growth, protein retention and utilization of growing male Saanen kids. Small Ruminant Research 39: 243-251
23. NRC, 1985, Nutrient Requirements of Sheep, 6th revised edition, Washington, DC.
24. Pajak, J.J., T. Zebrowska, A. Janocha, B. Kowalik and P. Dakowski 2001. Carcass composition of polish lowland and polish merino lambs fed diets containing different protein levels. Journal of animal and Feed Science 10:65-70
25. Park, J.H., S. J. Kim, N. Y. Kim, S. Y. Jang, J. W. Lee, Y. S. Yun1, and S. H. Moon 2018. Effects of dietary crude protein levels on intake, digestibility, and crude protein balance of growing korean native goats (Capra Hircus Coreanae). Journal of Animal and Plant Science 28(4): 981-988
26. Pearson, A. M. and T. R. Dutson 1991. Growth regulation in farm animals. Advances in Meat Research, Vol. 7. Elsevier,Newyork
27. Pirzado, S.A., M. Zakria, M. Tariq, M. H. Baloch, D.H. Kalhoro, I. H. Laghari, G.A. Mughal, F. Parveen and R. A. Lagari 2016. Effect of different levels of protein diets on growth performance and carcass yield of pateri male goat kids. Pure Appl. Biol 5(4): 1200-1206
28. Rios-Rincon, F.G., A. Estrada-Angulo, A. Plascencia, M.A. Lopez-Soto, B.I. Castro-
Perez, J.J. portillo-loera, J.C. Robles-Estrada, J.F. Calderon-Cortes and H. Davila-ramos 2014. Influence of protein and energy level in finishing diets for feedlot hair lambs: growth performance, dietary energetics and carcass characteristics. asian Australas. J. of Animal Science. 27(1): 55-61

29. Saro, C., J. Mateo, I. Caro, D. Eloy Carballo, M. Fernandez, C. Valdes, R. Bodas and F. Javier Giraldez 2020. Effect of dietary crude protein on animal performance, blood biochemistry profile, Ruminal fermentation parameters and carcass and meat quality of Heavy fattening Assaf lambs. MDPI Journal of Animals 10, 2177; doi:10.3390/ani10112177

30. SAS Institute 2007. Statistical Analysis System. STAT/ User’s Guide, Release 9.2, SAS Institute, Cary: NC. USA

31. Sharifi, M., M. Bashtani, A. A. Naserian and H. Khorasani 2013. Effect of dietary crude protein level on the performance and apparent digestibility of Iranian Saanen kids. African Journal of Biotechnology 12 (26): 4202-4205

32. Tang, J. E., D. R. Moore and K. W. Kujbida 2009. Ingestion of whey hydrolysate, casein, or soy protein isolate: effects on mixed muscle protein synthesis at rest and following resistance exercise in young men. Journal of Apple Physiology 107: 987-992

33. Titi, H.H., M.J. Tabbaa, M.G. Amasheh, F. Barakeh and B. Daqamseh 2000. Comparative performance of awassi lambs and black goat kids on different crude protein levels in Jordan.37:131-135

34. Tshabalala, P.A., P.E. Strydom, E. C. Webb and H.L. de- Kock 2003. Meat quality of designated south Africa indigenouse goat and sheep breeds. Meat Science 65: 563-670

35. Wang, X., T. Xo, X. Zhang, Y. Geng, S. Kang and S. Xu 2020. Effects of dietary protein levels on growth performance, carcass traits, serum metabolites, and meat composition of tibetan sheep during the cold season on the Qinghai Tibetan Plateau. MDPI Journal of Animals, 10, 801; doi: 10.3390/ani10050801