**Egyptian Journal of Sheep & Goat Sciences, Vol. 13, No. 1, P: 19-31 , April 2018**

# Effect of feeding Zaraibi male goats on rations containing different levels of corn steep liquor, as a source of protein, on growth performance and carcass quality.

**A. A. A. I. Gomaa and A.A. El badawy.**

Sheep and Goats Research Department, Animal Production Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.

Correspondence author: abdelhameed_20@yahoo.com

## ABSTRACT

The objective of the present study was to explore the influence of partial replacement of concentrate feed mixture (CFM) with corn steep liquor (CSL), as a low cost protein source, on growth / fattening performance and carcass quality of goat Zaraibi males. CSL added at four levels; 0, 10, 20, and 30%, based on crude protein content of the CFM.

Twenty male goats of almost similar age (3 months), were divided into four equal groups, five kids each. Groups were assigned at random to receive the four experimental fattening rations, along 3 month experimental period. The control ration was consisted of CFM and rice strow (RS) without CSL (A) while tested rations B, C and D supplemented with 10, 20 and 30 % CSL on the expense of CP of CFM portion of the control ration, respectively.

Results showed that total body weight gain was significantly higher with 10% CSL replacement level compared to the other three groups. The differences among treatments respecting hot carcass weight were not significant, but the heaviest weight correspondto ration (B). Dressing percentage (based on fasting weight) of kids was the highest for group fed ration (B), but without significant difference than rations A and D.

Carcass cuts of group (B) was greater than the other groups (A), (C) and (D). Carcass composition of lean, fat and bone weights based on (9, 10, 11$^{th}$ ribs) did not significantly affected by the dietary treatments. The differences among the experimental tratments in respect of most offals and internal organs were not-significant.

Chemical composition of lean in 9, 10, 11$^{th}$ ribs showed that protein content was higher with all tested rations (B , C and D) compared with control (A) and the differences were significant only between the ration had the low level of CSL (B) and the control (A). The highest fat % recorded with B followed by A while the lowest value detected with the high level of CSL (D). On the other hand, the effect of the tested rations on ash and moisture percentages as well as PH and color were not-significant.

***Key words: CLS, Carcass quality, Body weight, Zaraibi males.***

## INTRODUCTION

Nutrition and management are considered a crucial factors in determining the quantity, quality and economic efficiencies for meat production **(Agnihotri *et al.*, 2006)**. Simply, increasing profitability of small ruminant production depend on reducing the cost of production inputs while maximizing the output of the animal products. Any reduction in feed intake or increase in feed efficiency without compromising growth rate or carcass quality can have a significant positive economic impact on small ruminant **(Snowder and Van Vleck, 2003)**. Feed is the most important cost effective item for livestock production which represent 50-75% of the total production costs **(Safari *et al.*, 2012)**. Protein and energy are the two most importent constituents of animal' diets having vital role on their growth, production and reproduction performance **(Shahzad *et al.*, 2011).**

Generally, CSL on globel scale consider one of the most important by-product of corn starch processing. It is an exuberant source of nitrogen, vitamins, amino acids, peptides and soluble nutrients **(Nisa *et al.*, 2004)**. It contains about 40 % crud protein on dry matter basis and out of which more than 90 % in the form of amino acids and peptides. The same authors added that CSL could be successfully supplemented to a basal ration

based mainly on urea – treated wheat straw for buffalo bulls as an essential amino acids – protein source. Moreover, **Filipovic et al., (2002)** emphasized that CSL considera good source of protein, energy and minerals for farm animals. Biological traits of beef and dairy cattle have been enhanced by using CSL as a liquid source of protein supplement **(Gill, 1997 and Trenkle, 2002)**. However, still few data are available in literature related to using CSL in rations of male growing goats and its effect on productive performance and carcass quality. Therefore, the present study was directed to evaluate the effect of using CSL in rations of male Zaraibi goats on their growth performance, carcass quality and feed efficiency.

## MATERIAL AND METHODS

### 1 - Animals and experimental design

This study was conducted at El-Serw animal production Research Station belonging to Animal Production Research Institute (APRI), Agriculture Research Center, Ministry of Agriculture, Egypt. Twenty male Zaraibi goats at average age of 3 months were divided into four equal groups (five kids each) to examine the influence of partially replacement of concentrate feed mixture (CFM) with corn steep liquor (CSL), as a low cost protein source, at four rates; 0, 10, 20, and 30%, based on crude protein content of the CFM on growth performance, feed efficiency and carcass quality characteristics of Zaraibi males.

### 2 - Feeding and management

Corn Steep Liquor was obtained from Starch and Glucose Factory, Mostord, Cairo as a liquid by-product of wet milling process of maize-starch. It is viscouse and slurry with light to dark brown color, having ensiled odor and acidic pH **(Filipovic et al., 2002).** This unconventional feed ingredient contains high levels of soluble protein, glucose and minerals that make it useful to compensate the poor value of low quality forages by increasing the energy and protein levels without more fiber intake.

The control group (A) fed on basal diet having null CSL. The experimental groups (B), (C) and (D) fed on diets supplemented with CSL at rates 10, 20 and 30% of the diet, respectively as replacement of CFM based on its crude protein content. Kids were fed according to the allowances recommended by **NRC (2007)** for goats. Samples of CFM and rice straw (RS) were analyzed according to **A.O.A.C (2007).** The CFM was consisted of un-decorticated cotton seed meal (23%), yellow corn (43%), wheat bran (22%), soybean meal (5%), molasses (3.5%), limestone (2%) and common salt (1%). The daily experimental rations for animals were offered using the total mixed ration (TMR) feeding system and the ration formulations are presented in table (1). Both crude protein (CP) and metabolizable energy (ME) were ranged from 12.3 to 13.7 % and 1.573 to 1.659 MJ/Kg DM, respectively.

**Table (1): Formulation of the experimental total mixed rations (%).**

| Ingredients | *Experimental total mixed rations* | | | |
|---|---|---|---|---|
| | ***(A)*** | ***(B)*** | ***(C)*** | ***(D)*** |
| | **CSL 0%** | **CSL 10%** | **CSL 20%** | **CSL 30%** |
| **CFM** | **67** | **59.9** | **53.1** | **45.9** |
| **CSL** | **0** | **2.5** | **5** | **7.5** |
| **RS** | **30** | **34.6** | **38.9** | **43.6** |
| **Agrivate*** | **0.5** | **0.5** | **0.5** | **0.5** |
| **Sodium chloride** | **1** | **1** | **1** | **1** |
| **Limestone** | **1.5** | **1.5** | **1.5** | **1.5** |
| **Total** | **100** | **100** | **100** | **100** |

*Agrivate contains per kg Vit. A 1000000 IU; Vit. D3 200000 Iu; Vit. E; 10000 mg; Vit. B1; 1000 mg; Vit. B2 5000 mg;B6, 1500mg; Vit. B12, 10mg; Biotin, 50 mg; Colin Chloride, 250000 mg; Pentothenic, 10000 mg; Niacin, 30000 mg; folic acid, 1000 mg; Manganese, 60000 mg; Zink, 50000 mg; Iron, 3000 mg; Copper, 4000 mg; Iodine, 300 mg; Selenium, 100 mg and Cobalt 100 mg.

Water was available all time. Diets were offered twice daily at 8:0 am and 4 pm.**3- Experimental parameters measured:**

Animals were weighed at the bigining of feeding trial then fortnightly along the experimental period. Feeds refused was weighed daily where feed consumed was calculated and recorded. Three kids from each group were chosen for slaughtering test after 18-h fasting period where the fasting weights were recorded. Kids were slaughtered and after complete bleeding, were skinned and dressed out and hot carcass weight after removing all internal organs were recorded.

The empty body weight was obtained by subtracting the weight of gut contents from the fasted live weight. Dressing percentage was thus estimated either as a percentage of hot carcass weight relative to the fasted live weight (A) or as a percentage of the hot carcass weight relative to the empty body weight (B). Weights of carcass cuts, different internal organs and offals were also recorded.

The chilled 9,10,11$^{th}$ ribs was dissected into their physical composition of lean, fat and bone. The width and depth of longissumus dorsi muscle was measured to calculate the L. dorsi index (depth/ width)-100, weights and percentage of lean, fat and bone in 9,10,11$^{th}$ ribs.

The components of 9,10,11$^{th}$ ribs (lean and fat) of each carcass were minced and dried at 60$^{o}$C for moisture determination after reaching a constant weight. Samples from the mixture were analyzed chemically according to **A.O.A.C. (2007)** for ether extract, crude protein (N × 6.25) and ash contents.

The pH value of the lean-meat tissue was measured using pH meter (Bekman) according to the method described by **Krilova and Liskouskoia (1961)** using fresh samples. About 10 gm from lean-meat tissue of 9,10,11$^{th}$ ribs in 100 ml of distilled water were kept in a refrigerator for 2 hours.

**Economic efficiency:**

Economic efficiency was calculated as output to total input ratio according to the local prices (L.E/ton) during the time of execation of this study, where CFM cost 2800 L, CSL 600, RS 250 while the selling price of 1 Kg live body weight of kids was 35 L.E.

**Statistical analysis:**

Statistical analysis were carried out by using the least squares procedure for analyzing the data with equal subclass numbers described by **SAS (2009).**

$$Y_{ijk} = \mu + A_i + e_{ik}.$$

**Where:**

$\mu$ = general mean common element to all observations.

$A_i$ = an effect due to the i$^{th}$ treatment.

$e_{ijk}$ = random error particular to the ik$^{th}$ observations, assumed to be independently randomly distributed (O, $\delta^2$e). It includes all the other effects not specified in the model.

Tests of significant for the differences between means were carried out according to **Duncan's New Multiple Range Test (1955).**

## RESULTS AND DISCUSSION

### 1 – Chemical composition of feed ingredients

Chemical composition of feed ingredients and the experimental rations are presented in Table (2). Results showed that CSL contained 43.0 % DM, 33.5% CP, and 55.50% NFE. Similar results were recorded by **Khalifa et al., (2013) and Fatma E. Saba *et al.*, (2015)** for CSL. In another study, **Mirza and Mushtaq ( 2006 )** recorded higher crude protein content (40 %) in CSL as well as it contained relatively high values of ash and minerals while virtually free from CF. Moreover, **Wagner et al., (1983) and Gupta et al., (1990)** demonstrated that such by–product ingredients were free from fat, fiber and silica. It contains about 40% crude protein on dry

matter basis, out of which more than 90% is in form of amino acids and peptide **(Trenkle, 2002).** With increasing the levels of CSL in the experimental rations, CP tended to be slightly increased in the tested rations, being 12.31, 12.85, 13.25 and 13.70 % for rations A, B, C and D, respectively and these values are very suitable for small ruminant production. The chemical composition of CFM and RS excessively in agreement with those reported in the literature.

**Table (2):-Chemical composition (DM %) of feed ingredients and the calculated composition of the experimental rations.**

| Item | DM% | Chemical composition of DM (%) | | | | | | G.E*MJ/Kg DM |
|---|---|---|---|---|---|---|---|---|
| | | OM | CP | EE | CF | NFE | Ash | |
| **CFM** | **87.85** | **89.25** | **14.42** | **3.45** | **12.6** | **59.22** | **10.75** | **1.7632** |
| **CSL** | **43.00** | **90.00** | **33.50** | **1.00** | **---** | **55.50** | **10.00** | **---** |
| **RS** | **92.83** | **80.23** | **3.08** | **1.49** | **36.88** | **38.78** | **19.77** | **2.256** |
| **A** | **87.31** | **80.09** | **12.31** | **3.40** | **11.08** | **53.30** | **19.91** | **1.573** |
| **B** | **87.36** | **80.41** | **12.85** | **3.01** | **12.64** | **51.91** | **19.59** | **1.574** |
| **C** | **86.17** | **80.55** | **13.25** | **2.30** | **14.25** | **50.75** | **19.45** | **1.565** |
| **D** | **87.02** | **84.88** | **13.70** | **2.90** | **14.98** | **53.30** | **15.12** | **1.659** |

*Gross enrgy (GE) calculated according to **MAFF (1975)** using the following equation: GE, MJ/Kg DM= 0.0226 CP + 0.0407 CF + 0.0177 NFE.

**2 – Growth performance** :

**2.1 – Body weight and daily weight gain :**

Table (3) showed that the final live body weights for treatment groups ( A, B, C and D) were 19.60, 25.50, 21.40 and 21.40 kg, respectively where all treated rations were significantly higher than control one. The highest weight was associated with 10 % CSL ration. The corresponding total weight gain of the four groups were 10.45, 14.35, 10.70 and 10.30 with significant difference only between B and each of A, C and D treatments. Daily weight gain was significantly higher with kids fed ration B (159.44 g/d) than those fed the control ration (116.11 g/d) and the other tested rations being 118.89 and 114.44 g/d for C and D rations, respectively. So the best growth rate was achieved by the low level of CSL supplement (ration B). The findings of **Mirza and Mushtaq (2006)** confirm our results as it demonstrated that supplementation of CSL at 5 % of the diet is useful for growth and feed : gain ratio but higher levels of CSL considerably depress growth and increase feed : gain ratio, leading to increase cost of production. May with the higher levels of CSL, the normal rumen environment deviated than normal due to increasing rate of releasing free ammonia and other end products and thus impairing the rumen function. In prespective, the associative effects between the feeds (CSL and other ingredients in the present study) can modify the metabolic processes in rumen, so that the response of an animal to a combination of feeds can differ from the balanced median values of its components which could vary among individuals. This kind of response can be synergistic or antagonistic with a possible impact in nutrient utilization by the animals. Therefor, the modulatory effect of a certain ration for ruminant animal potentially depend on the diversity degree of its ingredients, balancing between macro / micro nutrients and its nutritional and syneigistic effects.

Meanwhile, these results suggest importancy to analyse CSL for anti nutritional factors and to investigate contaminant residuals resulted from extraction process of CSL. The obtained values in the present study is approximately similar with those obtained by **Fatma E. Saba *et al.*, (2015)** who used the same treatments with Zaraibi does and their

born kids where they reported that the highest value of daily body gain (from birth until weaning, at 90 days age), was recorded with 10% CSL (119 g) followed by 30% CSL (106 g), while 20% CSLand 0% CSL (control) recorded the lowest values (88 and 89 g, respectively).

**Table ( 3 ): Growth performance of kids in the fattening experiment.**

| Items | Treatments | | | | standard error |
|---|---|---|---|---|---|
| | (A) CSL 0 % | (B) CSL 10 % | (C) CSL 20 % | (D) CSL 30 % | |
| **Initial LBW** | 9.15 | 11.15 | 10.70 | 11.10 | ± 0.65 |
| **Final LBW** | 19.60 c | 25.50 a | 21.40 b | 21.40 b | ± 0.44 |
| **Total gain (Kg)** | 10.45 b | 14.35 a | 10.70 b | 10.30 b | ± 0.80 |
| **Daily gain ( g/day) :** | 116.11 b | 159.44 a | 118.89 b | 114.44 b | ± 8.87 |
| **Feed consumption (gm/day)** | 492.53 c | 614.25 a | 539.39 b | 557.08 b | ± 13.63 |
| **Feed conversion** | 4.39 ab | 3.87 b | 4.56 ab | 5.07 a | ± 0.36 |

a,b, means within the same row with different superscripts are significantly different at ( P<0.05).
Feed conversion = Feed consumption / Daily gain.

**2.2 – Feed consumption and feed conversion:**

Table (3) show that the feed consumption of treatments groups ( A, B, C and D ) were 492.53, 614.25, 539.39 and 557.08 gm/day, respectively with significant differences only between tested rations B, C and D versus control one. The highest feed consumption was associated with 10 % CSL (ration B). The values of feed conversion for treatments (A, B, C and D) were 4.39, 3.87, 4.56 and 5.07, respectively with no significant differences among the different tested rations and control one. The favourable value of feed conversion associated with group B (10 % CSL). The positive effect of low CSL supplement level on performance and feed conversion ratio may be attributed to the good effect for CSL on ruminal functions and digestion as reported by **Nasir et al., (2012) and Fatma E Saba *et al.*, (2015).**

**Shahzad et al. (2010)** revealed a linear increase in feed consumption with gradual replacement of urea by corn steep liquor. Similar trends were noticed on CP, ADF and NDF intakes. There was significant increase in DM and other nutrients digestibilities with gradual replacement of urea by CSL. Increasing trend of nutrients intake by gradual replacement of urea with CSL might be attributed to ascending availability of peptides and some amino acids on the cost of ammonia due to hydrolysis of CSL rather than exclusive availability of ammonia in lambs fed on urea alone. Specifically CSL is a concentrated thick and complex mixture of carbohydrates, amino acids, peptides, organic compounds, inorganic ions, and myo- inositol phosphates derived from wet corn milling **(Nisa et al., 2004).** Also it contains some fermentable energy which with hydrolysis yields keto acids and the release of rumen ammonia nitrogen with keto acids might synchronize the availability of nitrogen (N) and carbon units in rumen for enhanced microbial proliferation leading to improve feed degradation and utilization. In rumen, adequate and gradual supply of nutrients by replacing urea by CSL boosts up microbial synthesis which might increase feed intake because increased microbial efficiency has also been linked to increased feed intake **(Haddad et al., 2005)**. The efficience of capturing dietary nitrogen and the synthesis of microbial protein by the rumen microbial population, both require a balanced supply of both nitrogen and energy. When the supply of these key nutrients becomes unbalanced, losses of nitrogen as ammonia occur across the rumen wall which subsequently lost as urea in urine and consequently affect unfavorably on feed utilization.

**3 – Carcass characteristics and slaughter test :**

**3.1 – Fasting and empty body weights:**

The effect of dietary tretments on fasting and empty body weights and the other mesurements of carcass are presented in Table (4). Results showed that differences among the dietary tretments respecting fasting and empty weights were not significant and that highest values were occurred with 30 % CSL ration (D).

These results are in accordance with the findings reported **by Shahzad et al., (2010)** who reported that pre-slaughtering weight of lambs remained significantly unchanged across all treatments incorporated CSL at rates 0, 20, 40, 60 or 80 % of the dites of growing lambs..

**3.2 – Hot carcass weight, dressing percentage and carcass cuts :**

The effect of experimental rations on hot carcass, dressing percentage and carcass cuts are presented in table (4). Results showed no significant differences among treatments in hot carcass weights. While dressing perecentage, that based on fasting weight of all tested rations, did not differ significantly than control one. The highest value occurred with ration contained the low level of CSL (B) which differ significantly than ration (C) having 20 % CSL. Otherwise, the dressing percentage, that based on empty body weights, seemed unsignificantly affected by all dietary treatments. Regarding carcass cuts, the weights of round, shoulder, lion and brisket for 10 % CSL (ration B) were significantly higher than control one (A), while there were no significant differences respecting these items between ration (A) and ration (D), but ration (C) had the lowest value among the three tested rations. The other carcass cuts (rack, neck and flank) weights did not significantly affected by the experimental trearments.

The obtained results in the present study are approximately similar with those obtained by **Shahzad et al., (2010)** on small ruminants. Similarly, the values of dressing percentage (relative to fasting weight) ranged from 50.2 to 52.7 %, whereas dressing (relative to empty weight) ranged from 56.4 to 59.5 % in slaughtered Rahmani sheep (**Abou Ammou and El-Hosseiny 1999).** While the values of dressing percentage in the present study was higher than the values obtained by Ahmed et al., (2011). Supporting to the present results, Estrada – Angulo et al. (2016) reveald that urea combination in the diets of feedlot lambs tended to have heavier carcass with no effects on the rest of carcass characteristics. They added that starch:acid detergent fiber (ADF) ratio increased and that average daily gain, gain:feed, dietary net energy, carcass weight, dressing percentage and longissimas muscle area increased linearly ($P \leq 0.5$).

**3.3 –Meat components and quality:**

Carcass quality measurements of the *longissimus dorsi muscle* for kids fed the experimental rations are presented in Table (5). Results indicated that differences among dietary treatments respecting lean, fat and bon weights were not significant, but excessively the best values realated to lean and fat weights are in favour of 10 % CSL (ration B). Also, the favourable values respecting lean/fat, lean/bone and lean plus fat/bone were associated with the ration contained the lower level of CSL, while the worst values responded by the control group. Concerning the width and depth of longissmus dorsi muscle measurements, its values appeared to be unaffected significantly by the treatments, with the highest value respecting width measure in group fed ration (B).

The values of lean/fat and lean/bone in the present study approximately similar to those reported by Ahmed (2003) and Allam et al., (2007) for Zaribi kids and Farafra lambs, respectively.

Moreover, the results obtained by Agbossamey et al. (1998) are in support with the current results where they found no significant effect on carcass characteristics, in particular carcass lean yield, due to supplement of basal diets (forages conserved as hay or silage) with canola meal or fish meal as protein supplements to lambs. Similar effect was also found by Shahzad et al. (2010) who demonstrated that lean, fat and bone proportions of the carcass cuts did not significantly affected when urea was replaced with CSL in the diets of growing lambs.

**Table (4):** Fasting weight, empty boody weight, hot carcass, dressing percentage (DP) and carcass cuts weight of kids in the fattening experiment.

| Itmes | Groups Treatments | | | | standard error |
|---|---|---|---|---|---|
| | (A) CSL 0 % | (B) CSL 10 % | (C) CSL 20 % | (D) CSL 30 % | |
| Fasting W. (kg) | 22.00 | 25.00 | 23.33 | 25.67 | ± 1.08 |
| Empty W. (kg) | 19.37 | 22.52 | 20.79 | 23.05 | ± 1.10 |
| Hot carcass W. (kg) | 11.28 | 13.33 | 11.73 | 12.78 | ±0.58 |
| Dressing percentage 1 | 51.17 ab | 53.37 a | 50.26 b | 51.07 ab | ±0.70 |
| Dressing percentage 2 | 58.12 | 59.29 | 56.49 | 57.04 | ±1.03 |
| Carcass cuts weights (kg): | | | | | |
| Round | 5.91 b | 5.93a | 5.10b | 5.50ab | ±214.78 |
| Shoulder | 1.79 b | 2.11 a | 1.89 ab | 2.05 ab | ±76.27 |
| Loin | 0.64 b | 0.90 a | 0.77 ab | 0.82 ab | ±56.69 |
| rack | 2.02 | 2.34 | 2.06 | 2.21 | ±115.72 |
| neck | 0.92 | 0.94 | 0.94 | 1.04 | ±63.03 |
| flank | 0.72 | 0.74 | 0.68 | 0.80 | ±55.61 |
| brisket | 0.28 b | 0.38 a | 0.29 b | 0.35 ab | ±14.77 |

a,b, means within the same row with different superscripts are significantly different at ( P<0.05).
Dressing percentage 1= Hot carcass weight / Fasting body weight
Dressing percentage 2= Hot carcass weight / empty body weight

The non significant effects on carcass quality reflect the suitability and potential of CSL as a suitable ingredient to replace the NPN compounds like urea in the diet of growing lambs. In fact the worst difficulty for the meat production sector is marketing heterogenous products. Thus the diets formulation based as possible on good quality forage (fresh, silage and hay) and some supplementation of concentrates was developed in experimental farm to demonstrate high quality carcass and meat production.

**3.4 – Offals and Internal organs weights :**

The offals and internal organ weights of Zaraibi kids as affected by the CSL levels (0 ,10 ,20 30 %) are summarized in Table (6). Results indicated that most offals and organ weights did not significantly affected by the experimental rations. The values of different offals and organs in the present study were nearly similar to those obtained by **Gabr et al., (2003)** on growing Rahmani lambs who found that values of total offals as % of fasting weight ranged from 3.73 to 4.04 %. In this respect, **Ahmed (2003)** and **Ahmed et al., (2011**) observed that most weights of offals and organs were not significantly affected by the diets of Zaraibi kids and Rahmani lambs, respectively. **Shahzad et al., (2010)** observed that skin, heart, liver, kidney and heart weights remained significantly unchanged when urea replaced with CSL in the diets of growing lambs.

**4 – Chemical analysis, PH and color of lean:**

The chemical analysis, PH and color of 9, 10, 11$^{th}$ ribs of Zaraibi kids as affected by the tested levels of CSL (0 ,10 ,20 and 30 %) are summarized in Table (7). Chemical composition of L.D.% showed that protein content was significantly higher only with ration (B, 75.84) than other rations tested rations (70.74%, 71.38 and 71.63 % for A, C and D, respectively).

**Table (5) : Lean, fat and bone in 9, 10, 11th ribs, meat components and L. dorsi measrements of kids fed the experimental rations.**

| Itmes | Treatments | | | | standard error |
|---|---|---|---|---|---|
| | (A) CSL 0 % | (B) CSL 10 % | (C) CSL 20 % | (D) CSL 30 % | |
| Lean w (gm) | 152.27 | 180.47 | 146.30 | 149.07 | ±10.52 |
| Fat w (gm) | 32.13 | 27.50 | 33.08 | 34.83 | ±8.70 |
| Bone (gm) | 85.97 | 79.24 | 72.41 | 84.14 | ±7.22 |
| Meat components : | | | | | |
| Lean/ fat % | 4.77 | 6.91 | 5.06 | 5.09 | ±1.23 |
| Lean/ bone % | 1.77 | 2.28 | 2.09 | 1.80 | ±0.16 |
| Lean +fat / bone % | 2.14 | 2.63 | 2.54 | 2.20 | ±0.13 |
| L. Dorsi measrements: | | | | | |
| Width (mm) | 4.47 | 4.70 | 3.37 | 4.60 | ±0.24 |
| Depth (mm) | 2.65 | 2.53 | 2.40 | 2.67 | ±0.15 |
| Index % | 59.48 | 54.17 | 55.41 | 57.97 | ±2.91 |

L. Dorsi = Longissimus dorsi Index % = (depth / width)*100

a,b, means within the same row with different superscripts are significantly different at ( P<0.05).

**Table (6): Body offals and internal organs weights (kg) of kids fed the experimental ration.**

| Itmes | Treatments | | | | standard error |
|---|---|---|---|---|---|
| | (A) CSL 0 % | (B) CSL 10 % | (C) CSL 20 % | (D) CSL 30 % | |
| Belt | 1.67 | 1.85 | 1.71 | 1.70 | ± 112.34 |
| Head | 1.50 c | 1.93 a | 1.80 ab | 1.69 b | ± 42.04 |
| Legs | 0.71 | 0.77 | 0.67 | 0.74 | ± 32.05 |
| Digestive tract full | 4.53 | 4.45 | 4.58 | 4.56 | ± 295.09 |
| Digestive tract empty | 1.89 | 1.97 | 2.04 | 1.94 | ± 136.43 |
| Tests | 0.23 | 0.23 | 0.22 | 0.27 | ± 18.82 |
| Spleen | 0.05 | 0.04 | 0.03 | 0.03 | ± 5.00 |
| Kidneys | 0.09 | 0.08 | 0.09 | 0.09 | ± 10.19 |
| Heart | 0.10 | 0.11 | 0.11 | 0.09 | ± 12.44 |
| Lungs and traches | 0.27 | 0.29 | 0.30 | 0.240 | ± 19.56 |
| Liver | 0.40 | 0.39 | 0.40 | 0.39 | ± 88.80 |
| Internal fat | 0.30 | 0.20 | 0.21 | 0.33 | ± 52.78 |
| Kidneys fat | 0.11 | 0.07 | 0.03 | 0.13 | ± 28.04 |
| Heart fat | 0.04 ab | 0.04 ab | 0.02 b | 0.05 a | ± 5.91 |
| Small intestine | 0.80 | 0.78 | 0.77 | 0.77 | ± 81.91 |
| Large intestine | 0.67 | 0.71 | 0.72 | 0.64 | ± 74.14 |
| Rumen full | 2.55 | 2.11 | 2.75 | 2.81 | ± 244.13 |
| Rumen empty | 0.81 | 0.71 | 0.83 | 0.78 | ± 50.15 |

a,b, means within the same row with different superscripts are significantly different at ( P<0.05).

Fat % showed the highest level with ration B (19.28%) which not differ significantly than rations A and C (18.78 and 18.68%, respectively) while the significantly ($P < 0.05$) lower one was ration D (15.62%). On the other hand, the effect of the tested rations on ash and moisture percentages as well as PH and color were non-significant. The chemical composition in the present study were approximately similar with **those of Gabr et al., (2003), Abdelhamid et al., (2004)** and **Ahmed et al., (2011)** with growing lambs. But, protein % in the present study was noticeably lower (ranged from 70.74 to75.84) than those reported by **Ahmed (2003)** for Zaraibi kids (78.96 to 85.30%) and this may be attributed to difference in animals ages**.** Generally, the results obtaind earlier by **Jurie et al. (2000)** showed that the nature of the diet offered to beef steers can modify some of the tissue characterisitcs determinant for meat quality partly through changes in the balance of nutrients supplied to muscle and in the hormonal status of the animal.

**Table (7): Some physical properties and chemical composition of lean of 9, 10, 11th ribs of kids fed the experimental rations.**

| Itmes | Treatments | | | | standard error |
|---|---|---|---|---|---|
| | (A) CSL 0 % | (B) CSL 10 % | (C) CSL 20 % | (D) CSL 30 % | |
| **Moisture %** | **73.34** | **71.66** | **72.26** | **70.82** | **±1.09** |
| **Ash %** | **3.73** | **3.72** | **3.51** | **3.58** | **±0.14** |
| **Protein %** | **70.74 b** | **75.84 a** | **71.38 b** | **71.63 b** | **±0.61** |
| **Fat %** | **18.78 a** | **19.28 a** | **18.68 a** | **15.62 b** | **±0.57** |
| **pH** | **6.10** | **6.20** | **5.97** | **5.83** | **±0.11** |
| **Color** | **0.21** | **0.32** | **0.25** | **0.28** | **±0.05** |

a,b, means within the same row with different superscripts are significantly different at ( $P<0.05$).

## 5 - Economic efficiency:

The economic efficiency of Zaraibi kids in response to the tested levels of (CSL 0 ,10 ,20 and 30 %) are summarized in Table (8). Results showed that cost of one kg live weight of D group was less expensive than other groups. The economic efficiency were 3.58, 4.22, 3.98 and 4.13 L. E for groups A, B, C and D, respectively. Economically, **Nisa et al. (2004)** reported that CSL is consider as a major by-product of corn starch processing and can be utilized as an inexpensive source of nitrogen, vitamins, amino acids, peptides and soluble nutrients. Recently, **Fatma E. Saba et al. (2015)** concluded that replacing concentrate feed mixture with CSL at rates 10, 20 or 30 % on the basis of crude protein in the diets could improve feed utilization efficiency and increase the productive performance of goats and their offspring. Moreover, the results obtained by **Mirza and Mushtaq (2006)** demonstrated that supplementation of CSL at 5 % of the diet is useful for growth and feed:gain but higher levels of CSL considerably depress growth and increase feed:gain, leading to increase cost of production. It is worthy to note that in most countries carcass quality grade is much more important than carcass yield grade to determine the price of beef, thus, beef producers have to develop the key management factors (feeding system, nutrition and ration formulation) in order to increase the carcass quality grade, in particularly accretion of lean on the expense of fat in the carcass.

## CONCLUSION

It could be conclude that partial replacement of CFM with CSL at 0 ,10 ,20 and 30 % levels, on the basis of crude protein, could improve feed efficiency, total gain, daily gain, dressing percentage, most carcass quality characteristics and economic efficiency. However, the best results achieved when CSL replaced at 10 %.

**Table ( 8): Economic efficiency of fattening kids fed experimental rations.**

| Itmes | Treatments | | | |
|---|---|---|---|---|
| | (A) | (B) | (C) | (D) |
| **Daily gain, (gm/day)** | **116.11** | **159.44** | **118.89** | **114.44** |
| **CFM/h/d, gm as fed** | **390.39** | **437.79** | **338.70** | **301.09** |
| **RS/h/d, gm as fed** | **165.42** | **293.32** | **234.82** | **270.67** |
| **CSL/h/d, gm as fed** | **0.0** | **37.33** | **65.16** | **100.51** |
| **Price of CFM/h/d, LE** | **1.093** | **1.226** | **0.948** | **0.843** |
| **Price of RS/h/d, LE** | **0.041** | **0.073** | **0.059** | **0.068** |
| **Price of CSL/h/d, LE** | **0.0** | **0.022** | **0.039** | **0..060** |
| **Total price of feed consumed. LE** | **1.134** | **1.321** | **1.046** | **0.971** |
| **Price of kg gain, LE** | **4.06** | **5.58** | **4.16** | **4.01** |
| **Economic efficiency** | **3.58** | **4.22** | **3.98** | **4.13** |
| **Economic improvement %** | **-----** | **17.88** | **11.17** | **15.36** |

Price of kg gain, LE = (Daily gain/1000)*35 LE

Economic efficiency = Price of kg gain, LE / Total price of feed cost consumed. LE

## REFERENCES

**Abdelhamid, A.M., F. F. Abou Ammou, A.E. Abdel-Khalek, M.E. Ahmed, E.I. Shehata and G.A. Maged (2004).** Effect of dietary supplementation with chamomile flowers on carcass characteristics and histology of some organs in Rahmani sheep. J. Agric. Sci. Mansoura Univ., 29 : 6119.

**Abou Ammou, F.F. and H.M. El-Hosseiny (1999).** Performance and carcass characteristics of lambs fed Biotonic and Bosporo as feed additives, in summer and winter seasons. Egyptian J. Nutrition and Feeds, 2: 57.

**Agbossamey, Y. R., H. V. Petit, J. R. Seoane and G. J. St-Laurent (1998). Performance of lambs fed either hay or silage supplementd with canola or fish meals. Can. J. Anim. Sci. 78 : 135 – 141.**

**Agnihotri, R., Altabet, M.A. and Herbert, T.D. (2006).** Influence of marine denitrification on atmospheric $N_2O$ variability during the Holocene. *Geophysical Research Letters 33: doi: 10.1029/2006GL025864. issn: 0094-8276.*

**Ahmed, M.E.; O. A. EL- Zelaky, K. M. Aiad and E. I. Shehata (2011).** Response of small ruminants to diets containing red forage either as fresh, silage or hay versus berseem hay. Egypt, J. of Sheep and Goat Sciences; 6 (1).

**Ahmed, M.E. (2003).** The economic marketing weight of male Zaraibi goats. Egyptian J. Nutrition and Feeds. 6 1311.

**Allam, S.M., Faten F. Aboo-Ammou, A.M. Ali and Shaimaa R. Abd-Elgaber (2007).** Effect of Zinc supplementation on the performance and carcass characteristics of Growing lambs fed rations differ in crude protein content. J. Agric. Sci. Mansoura Univ., 32 (5) : 3393.

**AOAC (2007).** Association of Official Analytical Chemists. Official Methods of Analysis. 19th Edition. Washington DC, USA.

**Duncan, D. (1955).** Multiple ranges and multiple F-test. Biometrics, 11: 1.

**Estrada – Angulo, A., M. A. Lopez – Soto, C. R. Rivera – Mendez, B. I. Castro, F. G. Rios, H. Davila – Ramos, A. Barreras, J. D. Urias –Estrada, R. A. Zinn and A. Plascencia (2016**). Effect of combining feed grade urea and a slow – release urea product on performance, dietary energetics and carcass characteristics of feedlot lambs fed finishing diets with different starch to acid detergent fiber ratio. Asian Aust. J. Anim. Sci., 29 (12) : 1725 – 1733.

**Fatma E. Saba, Behery, H. R., , A. A.A. I.Gomaa, A. M. Abdel-Gawad, E. I. Shehata and M. E. Ahmed.(2015).** Evaluation of corn steep liquor as low cost proteins source on performance of dairy Zaraibi goats. 3rd International Scientific Conference on Small Ruminant Development, Hurghada, Egypt, 12-15 April,. J. of Sh. & G. Sci., Vol. 5 (1), P: 177-190.

**Filipovic, S. S., M. D. Ristic and M. B. Sakac, ( 2002).** Technology of corn steep application in animal mashes and their quality. Roum. Biotechnol. Lett.,7: 705-710.

**Gabr, A. A., E. I. Shehata, M. E. Ahmed and M. H. Azzam (2003).** Performance and carcass trails of Rahmani lambs fed rations containing dried poultry manure with addition of bentonite clay. Egyptian J. Nutrition and feeds. 6 (2): 173.

**Gill, C. (1997).** More value from imported maize. Feed International, August, 23-26.

Influence of using reed forage in defferent forms as fresh , silage and hay on blood profile and carcass quality of growing Rahmani sheep. Egyptian Journal of Sheep & Goat Sciences, Vol. 6 (2),25 – 35, 2011

**Gupta, R. S., M. C. Desai, P. M. Talpada, and P. C.Shukala, (1990).** Effect of corn steep liquor feeding on growth of crossbred calves. Indian J. Anim.Nutr. 7: 279-282

**Haddad, S.G., K. Z. Mahmoud, and H.A.Talfaha. 2005.** Effect of varying levels of dietary undegradable protein on nutrient intake, digestibility and growth performance of Awassi lambs fed on high wheat straw diets. Small Rumin. Res. 58: 231–236.

**Jurie, C., D. Bauchart, A. Listrat, B. Picard, X. Giraud, D. Dozias, R. Jailler, Y. Geay and J. F. Hocquette (2000).** Influence du rythme de croissance et de la nature de L`alimentation sur les caracteritiques musculaires de charolais de zo mois. Viands et oroduits carnes, hors serie : 59 – 64.

**Khalifa, E. I., H. R. Behery, Y. H. Hafez, A. A. Mahrous, , Amal Fayed, A. and Hanan Hassanien, , A. M. (2013).** Supplementing non-conventional energy sources to rations for improving production and reproduction performance of dairy Zaraibi nanny Goats. Egyptian J. Sheep &Goat Sciences, Vol.8 (2), P:69-83

**Krilova, N. N. and Liskovskaia, U. N. (1961):** Physical and chemical methods of analysis of animal products, Food ind. Pub., Moscow.

**MAFF(1975):** Energy Allowances and Feeding Systems for Ruminants. UK Ministry of Agriculture, Fisheries and Food, Technical Bulletin No. 33. HMSO, London. pp: 63-67.

**MIRZA M. A.; AND T. MUSHTAQ ( 2006 ).** Effect of Supplementing different levels corn steep liquor on the post-weaning growth performance of pak-karalul lambs. Pakistan Vet. J., 26(3): 135-137.

**Nasir, T. A., M. Sarwar, and M. A. Khan. (2012).** Influence of urea treated wheat straw with or without corn steep liquor on feed consumption, digestibility and milk yield and its composition in lactating Nili-Ravi buffaloes. Asian-Aust. J. Anim. Sci. 6: 825.

**Nisa, M., M. Sarwar, and M.A. Khan, (2004).** Influence of ad libitum feeding of urea treated wheat straw with or without corn steep liquor on intake, in situ digestion kinetics, nitrogen metabolism, and nutrient digestion in Nili-Ravi buffalo bulls. Austr. J. Agric. Res., 55: 235-239.

**NRC (2007).** Nutrient Requirements of Small Ruminants: sheep, goats, cervids, and New World camelids. National Research Council of the National Academies, National Academies Press, Washington, D.C., U.S.A.

**Safari, J., Kifaro, G.C., Mushi, D.E., Mtenga, L. A., Adnøy, T. and Eik, L.O. (2012).** Influence of flushing and season of kidding on reproductive characteristics of Small East African goats (does) and growth performance of their kids in a semi arid area of Tanzania. African Journal of Agricultural Research, 7(35): 4948-4955.

**SAS (2009).** SAS/STAT® 9.2 User's Guide, 2nd ed. SAS Institute Inc, Cary, NC, USA.

**Shahzad , M. I ; S. Muhammad; Mahr-un-Nisa ; M. Sharif, (2010).** Corn steep liquor, a potential substitute of urea on growing lambes. 3rd International Scientific Conference on Small Ruminant Development, Hurghada, Egypt, 12-15 April,. J. of Sh. & G. Sci., Vol. 5 (1), P: 177-190

**Snowder G. D. and Van Vleck L. D.** (2003). Estimates of genetic parameters and selection strategies to improve the economic efficiency of post weaning growth in lambs**.** J. Anim. Sci. 2003. 81:2704–2713**.**

**Trenkle, A., (2002).** Beef Research Report, Iowa State University, Iowa, USA.

**Wagner, J. J., K. S. Lusby and G. W. Horn, (1983).** Condensed molasses, soluble corn steep liquor, fermented ammoniated condensed whey as protein sources for beef cattle grazing dormant native range. J. Anim. Sci., 57: 542-552.

**Younis, A. A., El-Shobokshy, A. S., Hafz, M. and Danasoury, M. S. (1973):** Effect of different levels of energy intake through alteration of roughage to concentrate ratio in rations for fattening lambs. Alex. J. Agric. Res., 21:229.

## الملخص العربي

### تأثير التغذية على علائق تحتوي على مركز منقوع الذرة كمصدر للبروتين على نمو ذكور الماعز الزايبي وجودة الذبيحة.

عبدالحميد أحمد عواد ابراهيم جمعه ، عادل عبد العزيز عبدالعزيز البدوى.

باحث بقسم بحوث الأغنام والماعز – معهد بحوث الإنتاج الحيواني مركز البحوث الزراعية – دقي – جيزة.
المراسلات : abdelhameed_20@yahoo.com

الهدف من هذة الدراسة هو تقييم تأثير الاستبدال الجزئي للعلف المركز بمركز سائل نقع الذرة (CSL) كمصدر للبروتينات منخفضة التكلفة ، عند اربع مستويات هي صفر ، 10 ، 20 ، 30 % على اساس محتوي العلف المركز من البروتين الخام على النمو والتسمين وجودة الذبيحة في ذكور الماعز الزرايبي. تم اختيار 20 ذكر ماعز عشوائيا في عمر (3 أشهر) من القطيع الموجود بالمحطة ، وقسمت عشوائياً إلى أربع مجموعات متساوية ، خمسة ذكور لكل مجموعة لتغذيتها على علائق التسمين طوال فترة التجربة لمدة ثلاثة أشهر. تم تغذية مجموعة الكنترول (A) على العلف المركز وقش الارز بدون اضافة CSL وغذية المجموعات الاخرى (B ، C & D )على العلائق المختبرة مع مستويات 10 ، 20 ، 30 % من CSL على التوالي ، على حساب جزء من البروتين الخام من العلف المركز للكنترول.

وأظهرت النتائج أن :

لم يكن هناك تأثير معنوي للمعاملات على الزيادة الكلية في وزن الجسم وكانت اكبر قيمة عند المعاملة B (10 % CSL) واقل قيمة عند المعاملة ( D 30 % CSL). وخلافاً لذلك كان الوزن المكتسب اليومي هو الأعلى معنوياً للمعاملة B معاملة الكنترول وكذلك المعاملات المختبرة الآخرى (C & D).

الختلافات بين المعاملات بخصوص وزن الذبيحة الساخن غير معنوية ، وكان وزن الذبيحة للمعاملة B هو الأكبر بين معاملات التجربة. نسبة التصافي على اساس الوزن الصائم للجداء بالمعاملة B كانت أعلى غير معنوية عن مجموعة الكنترول A وكذلك المعاملة D ولكنها كانت أعلى معنوياً عن المعاملة C والتي بها اقل نسبة تصافي.

قطعيات الذبيحة للمعاملة B أكبر من المعاملات الآخرى سواء الكنترول A أو المعاملات المختبرة C & D. مكونات الذبيحة من اللحم الأحمر والدهن والعظام في قطعية الضلوع 9 ، 10 ، 11 وجد أن الاختلافات لكل من اللحم الأحمر والدهن والعظام بين المعاملات غير معنوية وكذلك النسب المختلفة اللحم الأحمر / الدهن ، اللحم الأحمر / العظام ، اللحم الأحمر والدهن / العظام ، والقياسات المختلفة للعضلة العينية كانت الاختلافات بين المعاملات جميعها غير معنوية. وكانت الاختلافات بين المعاملات لمعظم الأحشاء والأعضاء الداخلية غير معنوية.

التحليل الكيماوي للحم الأحمر في قطعية الضلوع 9 ، 10 ، 11 كانت نسبة البروتين الخام في المعاملات المختبرة B ، C & D أكبر من الكنترول A وكانت الاختلافات معنوية فقط بين المعاملة B وباقي المعاملات A ، C & D. نسبة الدهن كانت أعلى في المعاملة B يليها الكنترول A بينما كانت أقل قيمة مع المعاملة الأعلى مستوى من ال CSL وهي المعاملة D. وكان تأثير المعاملات المختبرة على نسبة الرماد ونسبة الرطوبة وكذلك ال PH واللون غير معنوى.

من هذه النتائج، يتضح أن:

التغذية على مركز نقع مياة الذرة كمصدر للبروتينات منخفضة التكلفة عند مستويات مختلفة (10 ، 20 ، 30 %) في علائق جداء الماعز الزرايبي النامية ، أدت إلى تحسن ايجابي في معدل النمو اليومي والوزن النهائي وكذلك نسبة التصافي ومعظم صفات جودة الذبيحة. وكذلك الكفاءة الاقتصادية وكانت افضل النتائج بصفة عامة عند التغذية على عليقة استبدال بنسبة 10 % من البروتين الخام للعلف المركز بمركز سائل نقع الذرة.

**Effect of feeding Zaraibi male goats on rations containing different levels of corn steep liquor, as a source of protein, on growth performance and carcass quality.**