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UTILIZATION OF CORN-COB MEAL AND FABA BEAN STRAW IN GROWING RABBITS DIETS AND THEIR EFFECTS ON PERFORMANCE, DIGESTIBILITY AND ECONOMICAL EFFICIENCY

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Abstract: *Weaned V-line rabbits aged 6 weeks (n: 84), were randomly distributed into 7 experimental groups to evaluate barley, corn-cob meal (CCM), Alfalfa hay, berseem hay (Egyptian clover) and dried Faba bean straw (**DFBS**). The evaluation included chemical analysis and effects of substituting 30% CCM instate of barley as an energy source with Alfalfa hay, berseem hay, or DFBS each at 25% as a fiber source on productive performance, carcass traits, nutrients digestion coefficients and economical efficiency. Each experimental group involved 12 rabbits, with 4 replicates of 3 rabbits each. The experimental period lasted from 6 to 12 weeks of age. Results could be summarized as follow:*

1- *Higher NFE and EE values present CCM as a potential energy source for livestock, while Alfalfa hay had higher CP and EE followed by berseem hay.*

2- *Higher feed intake (FI) was noted for the control, while lower FI were recorded for all other treatments which averaged 13.95 to 18.14% of the control. Impaired Feed conversion ratio (**FCR;** 3.69 g./ g.) was recorded due to feeding the control, with better FCR averaging 3.22 g./ g. for all other treatments.*

3- *Significantly higher protein, digestible energy (**DE**) and fiber intakes were noted for the control, while overall DE intake of the control was similar to CCM with Faba beans straw.*

4- *Lower abdominal fat was noted for CCM with Faba beans straw (5.73%), Moreover, an increase in small intestine length was recorded for CCM with Alfalfa hay (362.50 cm), and longer caecum was noted for rabbits fed Barley with Alfalfa hay (13.38 cm).*

*5- Digestion coefficients ranged from **68.37** to 77.75% for DM and 70.26 to 78.76% for OM. Feeding CCM with Faba beans straw increased CP digestibility over the control **(10.51%)** and also overall other dietary treatments. Higher digestibility coefficients for CF **(27.94%)** and EE (75.67%) were associated with feeding CCM with Alfalfa hay.*

*6- Rabbits fed CCM with Alfalfa hay increased NFE digestibility by 12.57, **7.00**, 6.96 and **4.75%** over the control, Barley with Alfalfa hay, Barley with Berseem hay and CCM with Berseem hay, respectively. The highest TDN was recorded for CCM with Alfalfa hay **(68.8%)**. Also, the highest DCP was for CCM with Faba beans straw which was similar to Barley with Faba beans straw and Corn-cob meal with Alfalfa hay. Moreover, the highest DE value was for rabbits fed Corn-cob meal with Alfalfa hay (**3048** kcal /kg).*

7- Net revenue and relative economical efficiency values were maximized by feeding CCM with Berseem hay, followed by feeding Barley with Berseem hay and then by feeding CCM with alfalfa hay .

In conclusion, DFBS as a fiber source and CCM as an energy source can be substituted for dried clover and barley, respectively in growing rabbit diets without any adverse effect on performance or carcass traits. However, such ingredients might maximize feeding costs reduction which will be reflected on higher economical efficiency of growing rabbits.

INTRODUCTION

One of possible solution to the increasing shortage of meat production problem is by using small ruminant and semi-ruminant species, as rabbits. **(Mahsoub, 2007)**. As reported by **FAO (1981)**, rabbits as short-cycle animals have the ability, by increasing their production, to meet the upcoming world higher meat demand in future. Additionally, **FAO (1999)** declared that the world rabbit industry in 1998 produced nearly 1 million tones of rabbit meat for human consumption, of which (56%) came from intensive rabbit farms. Furthermore, rabbit meat is considered an important protein source to human due to the higher quality and lower fat content. Other advantages of rabbit as a meat producer animal, is that rabbit diets has a good advantage of lower price as compared to other livestock **(El-Raffa, 1994)**.

Investigating the possible utilization of fibrous foodstuff in rabbit diets is common and of particular importance in Egypt, as many indigenous ingredients and their by-products are fibrous **(Awadalla and Mohamed, 1997)**. With Egypt producing annually about 24 million tones of plant by-product **(El-Manylawi *et al.*, 2005)**, scientists are working to better define

useful by-products that could be utilized in rabbit diets, and to quantify what reliable effects these materials might have on rabbit's production.

The subject of dietary fiber has became more important as an economic considerations being increasingly involved in production process and cost. where feeding rabbits on high quantity of digestible fiber promoted a best fermentative activity especially at weaning stage (**Gidenne *et al.*, 2002**). Moreover, it is of a great importance that feeding rabbits diets with higher dietary fiber levels not only provides nutrient substances, but also has the function of maintaining micro-ecological balances of gut. promoting digestive system development and consequently improving the productive performance (**Gu, 2002**).

Rabbits are a non-ruminant plant-eating animals and the crude fiber (**CF**) has an important effect on keeping normal digestion. Encouraging results with agricultural wastes as non-classical feedstuffs have been reported by many investigators (**Ibrahim, 2000, Tag El-Din *et al.*, 2002 and Sarhan, 2005**).

On the other hand, higher inclusion levels of fiber reduced both dietary digestible energy (**DE**) content and the overall efficiency of DE used in growing rabbits (**Ortiz *et al.*, 1989; and García *et al.*, 1993**). Rabbit fiber digestion has been reviewed (**De Blas *et al.*, 1999**) and reported that the need of fiber is more particularly expressed during the post-weaning period (**Lebas *et al.*, 1998**). Lower fiber intake, without variations of fiber nature or origin, involves a lower growth rate during the two weeks post weaning (**Gidenne and Jehl, 1999**) that are often associated with intake troubles or digestive disorders, without an identification of a specific pathogenic agent (**Bennegadi *et al.*, 2001; Bennegadi, 2002**).

Due to limited information of using agricultural wastes, especially corn-cob meal (**CCM**) and dried Faba bean straw without pods (**DFBS**) as non-traditional ingredients in rabbit diets, main objectives of the current study included determination of the proximate analysis of barley, CCM. Alfalfa hay, berseem hay (Egyptian clover) and DFBS. In addition, studying the effect of 30% CCM incorporation replacing barley as an energy source with either of Alfalfa hay, berseem hay or DBH each at 25% inclusion level in growing rabbit diets on their productive performance, carcass traits, nutrients digestion coefficients and economical efficiency.

growing rabbits. corn- cob meal. Faba beans straw, digestibility.

Preparation of Tested Materials:

- Barley and Corn-cob meal:

Barley and Cob with grains (CCM) were purchased from local market. After complete dryness for the CCM in sunshine, both tested materials were ground in a heavy-duty high rotation hummer mill to obtain a suitable powder for feed industrialization and chemical analysis.

- Alfalfa hay hay and Berseem hay:

Egyptian clover was prepared by taking the 2nd cut, and then both tested materials were dried at 60°C for 24-48 hrs in an air drying ovens. After complete dryness, plants were chopped off into small parts which can be used in pellet diets.

- Dried Faba bean straw (DFBS):

The DFBS was prepared by cutting plants as reaching the physiological maturity (as leaves of the lower third were dried), then take off plants pods; then plants were dried at 60 $^{\circ}$C for 24-48 hrs in air drying ovens. After complete dryness, dried plants were chopped to obtain small suitable parts for feed industrialization.

Experimental Diets:

Seven experimental diets were formulated to cover all essential nutrient requirements for growing rabbits according to **De Blas and Mateos (1998)** as follow: the commercial control diet (**diet 1**), whereas the next three diets contained 30% barley with 25% either of Alfalfa hay meal (**diet 2**), berseem hay (**diet 3**) or DFBS (**diet 4**), and the last three diets contained 30% CCM with 25% either of Alfalfa hay meal (**diet 5**), berseem hay (**diet 6**) or DFBS (**diet 7**). All diets had nearly iso-nutritive value but were different in their components according to the purpose of study. The composition and calculated analysis of all experimental diets is shown in (Table 1).

Production Performance Traits:

Individual rabbits were bi-weekly weighed (**LBW**) from the beginning at 6 to 12 weeks of age. Weighing was done in the morning before receiving feed or water. Live Body Weight Gain (**BWG**) was calculated by subtracting the initial live body weighs from final ones of each growth period. Feed intake (**FI**) per rabbit was calculated on weekly intervals for each group. The equation of **(Abdel-Magid, 2005)** was applied to obtain the amount of feed consumed per rabbit. Average protein, digestible energy and fiber intakes were calculated by multiplying feed intake by percent of protein, digestible energy and fiber contents of experimental diets. Feed conversion ratio (**FCR**) values were obtained by dividing the amount of feed consumed/ rabbit by the corresponding weight gain. The equation of (**Abdel-Magid, 2005**) was applied to obtain FCR values.

Slaughter Traits:

At the end of the experimental period, 4 rabbits (2 males and 2 females) at 12 weeks age were randomly chosen from each treatment. Assigned rabbits were fasted for 16 hours before slaughtering and were individually weighted as pre-slaughtering weight. Animals were slaughtered by cutting the jugular veins of the neck . when complete bleeding was achieved, slaughter weight was recorded. After skinning, the carcass was opened down and all entrails were removed and the empty carcass, heart, liver, kidneys and spleen were separately weighed, each of them was proportioned to the live pre-slaughtering weight. Empty small intestinal and caecum weight and their lengths were determined. Dressing percentage was calculated according to **Steven *et al.*, (1981)**

Digestibility Trial:

A total number of 21 male V-line rabbits at 14 weeks of age were utilized to determine the apparent digestion coefficients of nutrients and nutritive values of all studied experimental diets. For 12 days, the total duration of this trial that was divided into a preparation period (8 d), and a collection period (4 d) according to **Abd-El Ghany (2006)**. Three animals for each treatment nearly similar in LBW were individually housed in metabolic cages to facilitate feces collection. Actual daily FI was recorded during the collection period. Feces were daily collected at fixed time in the morning, sprayed with 2% boric acid to trap ammonia released from feces, then dried at 60° C for 24 hrs in air drying oven. Feces were finely ground and mixed to insure sample uniformity and then stored for further chemical analysis.

Proximate analysis of experimental diet samples on a dry matter basis were carried out to determine the dry matter (**DM**), ether extract (**EE**), crude protein (**CP**), crude fiber (**CF**) and ash content according to (**A.O.A.C, 1995**). The nitrogen free extract (**NFE**) and the organic matter (**OM**) contents were calculated as follows:

NFE, % = 100 – (CP % + CF % + EE % + Ash %)
OM, % = (CP % + CF % + EE % + NFE %)

Nutritive values as digestible crude protein (**DCP**) and total digestible nutrients (**TDN**) were calculated according to the formula of (**Cheeke *et al.*, 1982**).

DCP, % = Digestibility coefficient of crude protein × crude protein % of the diet.
TDN, % = DCP % + DCF % + DEE % (2.25) + DNFE %

The digestible energy was calculated according to **Schneider and Flatt (1975)** by using the following equation: **DE** (*kcal / kg*) = TDN × 44.3

Economical Efficiency:

The economical efficiency for all experimental diets was calculated as the ratio between income (price of weight gain) and cost of feed consumed during the experimental period (**Abdella *et al.*, 1988**). The price of each kg of the experimental diets was calculated according to the price of the ingredients in the local market at the time of the experiment (2006). Economical efficiency was calculated from the following equation:

$$\textbf{Economical efficiency, \%} = \frac{\text{Net revenue (LE)}}{\text{Total feed cost (LE)}} \times 100.$$

Where:

Net revenue = price of weight gain (LE) - total feed cost (LE).

Price of weight gain (LE) = average weight gain (kg/ head) × price/ kg live body weight (LE).

Total feed cost (LE) = average feed intake (kg/ head) × price/ kg feed (LE).

Statistical Analysis:

Data were subjected to analysis of variance, using the General Linear Model (**GLM**) procedure of SAS program (SAS, 1999). In preliminary analysis of data, all first order interaction between main effects were observed to be statistically insignificant. So, these values were not included in the final model. The application of the least significant ranges among different treatment means was done according to Duncan (1955). The statistical model used was as follows: $Yij = \mu + T_i + S_j + e_{ijk}$

Where: **Yij** = the observation of the parameter measured, μ = the overall mean. T_i = the effect of dietary treatment, i = (1, 2... 7). S_j = the effect of sex, j = Male or Female. e_{ijk} = the experimental random error.

RESULTS AND DISCUSSION

Chemical Composition of Tested Materials

It is worthy to note that chemical constitutes of barley, CCM, Alfalfa hay hay, berseem hay and DFBS may vary according to climatic condition under which seeds were grown and the type of soil. Chemical analysis on a dry matter basis of tested materials is listed in (Table 2). Comparing the proximate analysis of barley with that of CCM, it is clear that barley has a higher DM, CP and NFE than of CCM by 3.04, 20.0 and 3.99%, respectively. The opposite was true with OM, CF and EE values which were higher in CCM by 2.04, 33.33 and 50% than barley, respectively. However, results of NFE (67.23%), EE (3.0%) and CP (8.0%) of CCM showed that it could be considered as a source of both energy and protein in livestock feeding. In regard to the chemical composition of Alfalfa hay hay, berseem and DFBS, it is clear that Alfalfa hay was rich in CP (17.3%) and EE (2.7%) followed by berseem hay (15.0 and 2.16%, respectively while, the opposite was true with DFBS which had the lowest values in this regard being 8 and 1.52%, respectively. On the other hand, DM, OM, CF and NFE of DFBS were higher by 1.85, 11.29, 25.00 and 29.18% over corresponding values of Alfalfa hay. Values of Alfalfa hay are generally similar to published results by Carabaño *et al.*, (1997) for DM, CP, CF and EE being 85.4, 20.3, 27.7 and 2.8%, respectively. Also, results of chemical analysis of berseem hay were nearly similar to findings of Zanaty and Ahmed (2000) who reported that DM, OM, CP, CF, EE and NFE of berseem hay were 89.0, 86.1, 16.9, 29.2, 2.9 and 37.1%, respectively. So, it is of a great importance to note that the higher CP content of Alfalfa hay and berseem hay is an indicator of their potential value as a source of protein, however, other nutrient substances are of relatively suitable values to rank these materials as feed ingredients for growing rabbits.

Biological Evaluation of Tested Materials:

Live Body Weights (LBW):

Effects of feeding either commercial diet (control) or tested experimental diets with different sources of energy and fiber on LBW of growing rabbits throughout the experimental growth periods (6 and 12 weeks of age) are elucidated in (Table 3). All rabbits have commenced with a nearly similar initial LBW which ranged between 1058.33 and 1066.67 g, this created a suitable condition to appraise the effect of dietary treatments on the performance of experimental growing rabbits.

Rabbits fed the commercial diet had numerically heavier LBW than those of other experimental diets. The opposite was true with feeding corn-cob meal with alfalfa hay (T5) which had slightly the lowest LBW. In accordance with the present results, El-Sayaad (1997) found that feeding rabbits on sun dried corn plant as a substitute for clover hay grew as much as those of the control group. Many investigators reported that the incorporation of agricultural fibrous by-products, *e.g* dried okra processing by-products up to 30% (Tag El-Din. 1996). dried potato tops up to 30% (Awad. 1997). sunflower cake up to 21.6% (Ismail and Gippert. 1999) and Leucaena leaf meal (Abd El-Galil *et al.*, 2001) did not have any negative effects on growing rabbits. No effects were noted for dietary treatments on sex. as insignificant differences were obtained in this respect.

Live Body Weight Gain (BWG):

Values of BWG were not influenced by either commercial diet or those contained different energy and fiber sources during studied experimental growth periods (6-8. and 6-12 wks. Table 3). Overall. BWG (6-12 wks) ranged from 1601.22 to 1569.09 g for the commercial diet and diet contained corn-cob meal with alfalfa hay (T5). respectively. So. present results show that there is an advantage of using tested materials in the diets of growing rabbits.

Results of Garcia *et al.* (1993) are in agreement with our findings. authors found that barley substitution by sugar beet pulp up to 15% did not reduce growth performance. Also. Genedy *et al.* (2000) reported that BWG of rabbits fed dried watermelon by-product inclusion up to 12% were not significantly different than those obtained from the control diet. Similar to the above mentioned results. insignificant effects due to sex difference were found among the experimental groups on BWG. During the over all experimental growth period (6-12 wks). males gained a slightly more weigh than females.

Feed Intake:

Data revealed that rabbits fed the commercial diet through the initial growth period (6-8 wks) consumed ($P \leq 0.001$) more feed by about 33.66. 31.48. 22.25. 26.46. 22.50 and 11.72% over all subsequent treatments. respectively (Table 3).

With feeding dietary treatments up to 12 weeks (overall). FI for rabbits fed the commercial diet was significantly ($P \leq 0.001$) higher by 16.29. 22.17. 16.22. 20.65. 16.07and 8.31% as compared to all subsequent experimental groups. respectively. Meanwhile. the lowest FI was recorded for rabbits fed barley with berseem hay (T3) which was statistically similar to all other dietary diets. except for the control and rabbits fed CCM with DFBS (T7). respectively.

Presented results of FI confirmed the findings of Zeweil (1992) who showed that rabbits having 50% pea by-product in their diet recorded higher FI by 23% than those fed the control diet. Moreover. Amber *et al.* (2002)

found that FI significantly ($P \leq 0.001$) increased for rabbits fed mung bean hay and rice straw compared with those received sugar beet pulp and sweet potato tops containing diets. Along the same line, Sarhan (2005) reported that the daily FI for rabbits fed 15 or 30% of pea vines hay and pea pods hulls was increased as compared to the control diet. Genedy *et al.* (2000) cleared that FI of rabbits fed dried watermelon by-product at levels up to 12% did not have significant difference ($P \geq 0.001$) when compared to the control diet. Furthermore, Al-Shanti (2003) observed insignificant differences in FI when rabbits fed 5 to 20% inclusion levels of either olive cake or olive pulp.

Feed Conversion Ratio:

Data in Table (3) revealed highly significant ($P \leq 0.001$) differences among all dietary treatments allover studied experimental periods. In general, obtained results show that V-line growing rabbits performed better as fed on the experimental dietary treatments than those fed the commercial diet. Through the first two weeks (6-8 wks), rabbits fed the control diet (T1) recorded the worst FCR value (3.52), followed by that of T7 rabbits fed CCM with DFBS (3.29) , while the best value was obtained with T2 rabbits fed barley with alfalfa hay (2.72) which was statistically equal to that of T3 rabbits fed barley with berseem hay (2.78).

Overall results for FCR (6-12 wks) showed that FCR was significantly ($P \leq 0.001$) impaired (3.69 g./ g.) as rabbits were fed the commercial diet, while other dietary treatments groups of T2, T3, T4, T5, and T6 were statistically similar and had better FCR values averaging 3.17 , while T3 group fed barley with berseem hay recorded the best FCR (3.08).

From these results, it is clear that FCR was significantly improved by the dietary inclusion of tested materials. These results agree with previous findings reporting that dietary inclusion of many agriculture by-products including carrot-top or corn cobs, dried watermelon, wheat bran or beet pulp, pea vines hay or pea pods hulls have resulted in better FCR values as fed to rabbits (Eleraky, 1996; Genedy *et al.*, 2000; Falcão-e-Cunha *et al.* 2004; and Sarhan 2005). No differences were found in regard to sex effect on FCR values.

Protein Intake:

Summarized in Table (4) the amounts of protein intake (PI: g/ rabbit/ period) during all experimental growth periods, showing significant differences ($P \leq 0.001$) among all dietary treatments. During the 1st growing period (6-8 wks), the control diet (T1) recorded significantly ($P \leq 0.001$) higher PI (359.41

g/rabbit) followed by those of T7 which fed CCM with DFBS (329.23 g/ rabbit): whereas the lowest PI value ($P \leq 0.001$) was recorded for T2 or rabbits fed diet contained barley with alfalfa hay (274.42 g/rabbit) followed by those of T3 being fed barley with berseem hay (278.35 g/ rabbit).

Regarding the overall experimental growth period (6-12 wks), it is clear that the effect of CCM diet on PI indicates the presence of significant differences among dietary treatments. Although, the highest PI was recorded by rabbits fed T1 diet, rabbits fed experimental diet contained CCM plus DFBS (T7) consumed more protein than those received barley plus DFBS diet (T4). This beneficial effect of feeding T7 may be attributed to its superiority values of DCP and that of CP digestibility. Similar result was observed by Morsy (2007) who indicated that CP digestibility and DCP in corn diets were higher than those of barley ones. Insignificant differences were detected among experimental groups of males and females in regard to PI values.

Digestible Energy Intake:

During the 1[st] experimental period , rabbits fed the control diet (T1) consumed significantly ($P \leq 0.001$) more DE being 5298.8 kcal / rabbit which was over those of other treatments especially T2 or rabbits fed barley with alfalfa hay by 28.34% which recorded the lowest DE intake (4128.58 kcal/ rabbit). The corresponding value of diet contained CCM with DFBS (T7) was also higher ($P \leq 0.001$) by 19.86% than that of T2.

For over all (6-12 wks) , DE intake of rabbits fed the commercial diet (T1) and those having CCM with DFBS (T7) were statistically similar of being the highest values, while rabbits fed diet contained barley with berseem hay (T3) recorded the lowest DE which was statistically equal to rabbits fed alfalfa hay with either barley (T2) , or CCM (T5) , respectively. Such reduction in DE intake may be due to reduced FI, (Table 3). It also is concluded from these results that incorporating CCM plus either DFBS or dried bersem hay into experi ental diets had a positive effect on DE when compared with diets contai d barley plus either studied materials as a fiber source.

Fiber Intake:

Table (4) illustrates that fiber intake values during all studied growth periods were significantly (**$P \leq 0.001$**) reduced with feeding tested diets. During all studied experimental periods, the lowest value was recorded by rabbits fed diet contained barley with alfalfa hay (T2) which contained 12% crude fiber, while rabbits fed upper fiber level of T7 (CCM with DFBS , 14.81% CF) consumed more fiber.

During the over all studied period (6-12 wks), the highest fiber intake was recorded by rabbits fed the commercial diet (T1) being 39.47% over those of rabbits fed barley with alfalfa hay (T2) which gave lower values. Also, a similar result was noted with rabbits fed CCM with DFBS (T7) which was higher by 31.53% over that of T2. Meanwhile, rabbits fed other experimental diets through all studied growth periods recorded an intermediate values in this regard.

According to FI values (Table 3) ; such results agreed with the findings obtained by Gidenne (1995) and Easa (2002) who found that rabbits fed on low fiber containing diet had lower feed intake than those fed higher fiber diets.

Slaughter Traits:

Slaughter traits of growing rabbits at 12 weeks of age expressed as, dressing percent and relative weights of edible and inedible organs are summarized in (Table 5). Dietary treatments T3 (barley with berseem hay) and T6 (CCM with berseem hay) gave the highest ($P \leq 0.001$) dressing values by 5.29 and 5.48%, respectively over the control. Consistent results were reported by Amber *et al.*, (2002) who showed that dressing percentage values were significantly lower for rabbits fed diets contained sugar beet pulp, sweet potato tops or mung bean hay than those received the control diet or that contained rice straw. Also, Sarhan (2005) reported that dressing percentages of rabbits fed pea vines hay or pea pods hulls supplemented diets were higher than the control group.

Edible Organs Percentage:

There were no significant differences related to heart, liver, kidney and spleen relative weights among rabbits fed dietary treatments. These results are coincided with previous findings that insignificant differences were found in liver, heart and kidney relative weights due to dietary inclusion of pea by-product (Zeweil 1992), Acacia leaves (Abd El-Galil and Khidr 2000a), and Vetch seed (Yalçin *et al.*,2003). The lowest (**$P \leq 0.05$**)

abdominal fat percent was recorded for rabbits of T7 which fed CCM with DFBS (5.73%) which was statistically similar to the control (6.63%), T5 rabbits fed CCM with alfalfa hay (6.03%) and T6 group which fed CCM with berseem hay (7.24%), respectively. However, the highest ($P \leq 0.05$) percent was obtained from rabbits of T4 which fed barley with DFBS (8.62 %). Lower abdominal fat percent obtained (T7) might be due to the lower protein consumed by rabbits as shown in Table (6) and reduced EE digestibility by feeding rabbits (T7) compared to other dietary treatments.

Such reduction in abdominal fat of T7 is in accordance with finding of Abdel-Azeem *et a.* (2000) and Morsy (2007) who reported that total non-carcass fat percentage was the lowest as rabbits were fed high fiber diets (14 or 17%), and the higher abdominal fat for rabbits fed barley diets may be a result to better digestion as compared to yellow corn with lower frequency of mycotoxin contamination in barley diets (Xiccato *et al.*, 2002).

Digestive Tract:

It is clearly shown that a highly significant increase ($P \leq 0.001$) in the length of small intestine was recorded by rabbits fed diets of CCM plus Alfalfa hay hay (T5), whereas caecum percent and length were higher for rabbits fed barley plus Alfalfa hay hay (T2; 3.80% and 13.38 cm, Table 5). It is worth to note that the longest small intestine (362.50 cm) and the intermediate caecum length (11.25 cm) resulted from feeding rabbits diet contained barley with alfalfa hay (T5) which had the best crude fiber digestibility (49.64%). This may be due to the higher digesta retention time, which leads to a longer fermentation time (García *et al.* 1996). Also, the least length of caecum was for rabbits fed the commercial diet which had an intermediate crude fiber digestibility (38.80%). The highest relative small intestine and caecum weights were for rabbits fed barley with alfalfa hay or T2 (9.29% and 3.80%, respectively) which contained an intermediate fiber digestibility (43.01%). These results are in agreement with finding of (Azzazy 1990, Amber *et al.* 2002) who reported a significant increase in gastrointestinal tract relative weight as rabbits were fed higher digestible fiber diets.

Digestion Coefficients of Experimental Diets:

Data in Table (6) show that digestion coefficient values for all nutrients were significantly ($P \leq 0.01$) improved by feeding dietary diets. In that, DM ranged from 68.37 to 77.75% for rabbits fed the control diet and T5 (CCM with alfalfa hay). This range was higher than that reported by Sarhan (2005) as DM digestibility ranged between 61.64 to 64.97% for Bouscat rabbits fed dietary pea vines hay and pea pods hulls partially or completely replacing clover hay. Similarly, OM digestibility ranged from 70.26 to 78.76% for rabbits fed the commercial and T5 (CCM with alfalfa hay) which was higher ($P \leq 0.05$) by about 12.10, 7.05, 7.38, 5.83, 6.19 and 5.38% over those fed other experimental diets of T1, T2, T3, T4, T6 and T7, respectively. Therefore, these dietary experimental diets could be considered suitable feeds for growing rabbits.

These results agree with findings of Ghazalah and El-Shahat (1994) who indicated that inclusion of olive meal instead of barley increased OM digestibility. Digestion coefficient of CP ranged between 70.19 to 77.57% for rabbits fed T1 (control diet) or T2 (barley with alfalfa hay) and those of T7 (CCM with DFBS), respectively. As feeding DFBS; T7 significantly ($P \leq 0.01$) increased CP digestibility values by 10.51% over T1 (control) or T2 (barley with alfalfa hay) followed by rabbits of T3 (barley with berseem hay) and then by rabbits of T6 (CCM with berseem hay), being 5.97% and 6.67%, respectively. Similarly, Al-Shanti (2003) reported a CP digestibility ranging from 70.35 to 75.43% for growing Flander rabbits fed dietary olive cake up to 20%.

Digestion coefficient of CF ranged from 36.61 to 49.64% for rabbits fed barley with DFBS (T4) and those fed CCM with alfalfa hay (T5). Dietary T5 significantly ($P \leq 0.01$) improved CF digestibility values by 27.94, 15.42, 17.08, 35.59, 10.83 and 24.13% over the control diet and those fed diets of T2, T3, T4, T6 and T7, respectively. These differences in CF digestibility may be due to CF constituents among different dietary fiber (Cheeke, 1986). Moreover, the digestion coefficients of CF were considerably depended on the type, source and fractions of dietary fiber (Santoma *et al* . 1989). Similarly, Ghazalah and El-Shahat (1994) found that the CF digestibility ranged from 29.9 to 37.2% for growing NZW rabbits fed dietary substitutions of olive kernel meal or dried sweet pea hulls replacing barley. Rabbits can utilize dietary fiber in range of 22.58 to 36.15% for NZW rabbits fed diets containing *Atriplex nummularia* leaves meal up to 30% (Abd El-Galil and Khider, 2000). Sarhan (2005) reported CF digestibility range of 33.1 to 40.53% for Bouscat rabbits fed pea vines hay or pea pods hulls substituting clover hay.

Ether extract digestion coefficients ranged from 71.82% (T3, barley with berseem hay) to 75.67% (T5, CCM with alfalfa hay) with significant differences ($P \leq 0.01$); meanwhile insignificant differences were noted among other dietary treatments. The best EE digestibility values were recorded by rabbits fed T5 (CCM with alfalfa hay) followed by T7 (CCM with DFBS), and the lowest value was for T3 (barley with berseem hay) . These differences may be attributed to the increase in EE content of CCM and Alfalfa hay diet. Dietary inclusion of agriculture by-products in rabbits diets and improved EE digestibility was reported by many investigators, (Genedy *et al.*, 2000; 60.2 to 66.88%); (Falcão-e-Cunha *et al.*, 2004; 74.1 to 86.9%), and (Sarhan, 2005; 77.19 to 80.03%), respectively.

Nitrogen free extract digestibility ranged from 77.78 to 87.56% for rabbits fed the control (T1) and those fed CCM with alfalfa hay (T5), which significantly ($P \leq 0.01$) increased NFE digestibility values by 12.57, 7.00, 6.96 and 4.75% over the commercial diet (T1), T2, T3 and T6, respectively. These results are supported by earlier findings of (Ghazalah and El-Shahat, 1994 and Sarhan, 2005) with feeding olive kernel meal or dried sweet pea hulls, pea vines hay or pea pods hulls, respectively. It can be concluded that CCM as an energy source and DFBS as a fiber source are of a great importance in improving nutrients digestibility values when incorporating into rabbits diets.

Nutritive Values:

The effect of feeding different studied experimental diets on nutritive values in terms of total digestible nutrients (TDN), digestible crude protein (DCP) and calculated digestible energy (DE) are tabulated in Table (7). Nutritive values of experimental diets were significantly ($P \leq 0.01$) different as a result of differences in nutrients digestibility of experimental diets. An increment of 8.24, 4.66, 8.27, 15.65, 6.05 and 7.28% was obtained for rabbits fed T2, T3, T4, T5, T6 and T7 over that of the control, respectively. Meanwhile, the highest TDN was recorded by rabbits of T5 which fed CCM with alfalfa hay (68.8%) as compared to the lowest value of the control (59.49%). This improvement in TDN values could be a result of increasing CP, EE and NFE digestibility as reported by Easa, (2002).

A similar trend was noted with DCP, with the highest for T7 group of rabbits fed CCM with DFBS (13.89%) which was statistically similar with those of T4 rabbits fed barley with DFBS (13.43%) and rabbits of T5 which fed CCM with alfalfa hay (13.62%), respectively, while, the lowest value was recorded by rabbits fed T2 (12.52%). In regard to DE of the experimental treatments, the highest ($P \leq 0.01$) DE value was recorded for rabbits fed T5 containing CCM with alfalfa hay (3048 kcal/kg), whereas the lowest DE (2636 kcal/kg) was for those fed the control diet. These poor values observed with commercial diet (control) might be attributed to the absorption of fairly large quantities of water that forms somehow a bulky mucilaginous mass which aids in the passage of feed more rapidly throughout the intestine as reported by Fraga *et al.*, (1991). In this connection, Amber *et al.*, (2002) observed an improve in TDN and DE values with diets high in digestible fiber source, whereas the lowest value of DCP was recorded by mung bean hay or rice straw diets of low CP digestibility. Also, feeding 30% pea pods hulls diet had better nutritive value over the control (Sarhan, 2005).

Economical Efficiency:

According to guide of economical evaluation, total feed cost/ rabbit, selling price, net revenue, economical efficiency and relative economical efficiency are presented in Table (8). Feeding dietary treatments resulted in a positive effect of improving net revenue being 11-12 L.E. This advantage may be due to their current lower price compared to the control. Thus, from the economical point of view, feeding growing rabbits on commercial diet gave the lowest economical efficiency value (1.16), whereas the best efficiency was for T6 (1.83) followed by T3, T5, T4, T7 and T2 being, 1.80, 1.77, 1.65, 1.64 and 1.52, respectively. These results are supported by those of FCR, in which rabbits fed on dietary treatments utilized feed more efficiently than the commercial diet (control). The relative economical efficiency was superior for T6 (57.8%) followed by those of T3, T5, T4, T7 and T2 being, 55.2, 52.6, 42.2, 41.4 and 31.0%, respectively over the control (T1).

In this respect, Ghazalah and El-Shahat (1994) found that feeding olive kernel meal or dried sweet pea hulls up to 50% substitution of barley had higher relative economical efficiency values of 144.7 and 163.1%, respectively. Also, Mohamed (1999) found that peanut hay inclusion to replace clover hay contributed in lowering the feeding cost and increased the economical efficiency. The cost of total feed intake was reduced with feeding different kinds of silage over the control and economical efficiency values of rabbits fed silage were higher compared to the control (Zeid *et al.*, 2001). Similarly, Sarhan (2005) indicated that the best economical efficiency values were for rabbits fed pea pods hulls or pea vines hay inclusion over the control diet

So, it could be concluded that CCM can be included in growing rabbit diets up to 30% as a source of energy with 25% inclusion level of either alfalfa hay, berseem hay or DFBS as fiber sources. It is of great importance to avoid the accumulation of diet in the caecum as well as different crude fiber sources can be combined to form new fiber ones that may be effective than when fed individually .

growing rabbits, corn- cob meal, Faba beans straw, digestibility.

In conclusion, chemical composition of tested materials may be considered as a preliminary indicator of possible potential of using such materials in growing rabbits feeding. Additionally, DFBS as a fiber source and CCM as an energy source can be substituted for dried clover and barley, respectively in growing rabbits rations without any adverse effect on performance or carcass traits. However, such ingredients might maximize reducing feeding costs which will be reflects on higher economical efficiency of growing rabbits.

Table (1): Composition and Chemical Analysis of Experimental diets

Ingredients, %	Experimental diets						
	1	2	3	4	5	6	7
Barely	20.0	30.0	30.0	30.0	-	-	-
Corn-cob meal	-	-	-	-	30.0	30.0	30.0
Yellow corn	7.5	4.0	2.5	5.3	-	-	-
Soybean meal (44%)	23.0	16.0	17.5	24.7	17.0	19.5	25.0
Coarse wheat bran	24.0	21.5	21.5	11.5	24.5	22.0	16.5
Alfalfa hay	11.0	25.0	-	-	25.0	-	-
Berseem hay	11.0	-	25.0	-	-	25.0	-
Faba bean straw	-	-	-	25.0	-	-	25.0
DL-Methionine	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Di-calcium phosphate	1.7	1.7	1.7	1.7	1.7	1.7	1.7
NaCl	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Limestone	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Vit. & Min. premix[1]	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Anti-coccidial & Growth promoter	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100	100	100
Chemical analysis, %:							
Crude protein[2]	17.2	17.86	17.82	17.96	17.93	18.07	17.91
Digestible energy (kcal/kg)[3]	2580	2687	2674	2705	2698	2714	2692
Crude fiber[2]	14.50	12.09	13.17	13.56	13.18	14.06	14.81
Ether extract[2]	2.19	2.51	2.34	2.01	2.79	2.59	2.30
Calcium[4]	0.90	0.98	0.93	0.89	0.98	0.93	0.84
Available phosphorus[4]	0.63	0.61	0.61	0.59	0.62	0.63	0.62
Methionine[4]	0.42	0.36	0.41	0.39	0.37	0.42	0.39
Lysine[4]	1.07	0.90	1.04	0.89	0.88	1.04	1.04
DE: CP[4]	150.0	150.4	150.1	150.6	150.5	150.2	150.3

[1]Vitamin and mineral premix contained per kilogram: 12000 IU Vit. A: 2200 IU Vit. D_3: 10 mg Vit. E: 2.0 mg Vit. K: 1.0 mg Vit. B_1: 4.0 mg Vit. B_2: 1.5 mg Vit. B_6: 0.001 mg Vit. B_{12}: 6.7 mg Pantothenic acid: 6.67 mg Vit. B_5: 1.07 mg Biotin: 1.67 mg Folic acid: 400 mg Choline chloride: 22.3 mg Zn: 10 mg Mn: 25 mg Fe: 1.67 mg Cu: 0.25 mg I: 0.033 mg Se and 133.4 mg Mg.

[2]Analyzed [3]Calculated as: DE (kcal / kg) = TDN × 44.3 (Schneider and Flatt, 1975)

[4]Calculated

Table (2): Chemical composition of tested materials used in the experimental diets (% on DM basis)

Item	DM	Ash	OM	CP	CF	EE	NFE
Barley	92.76	10.99	89.01	9.60	7.50	2.00	69.91
Corn-cob meal	90.02	11.77	88.23	8.0	10.0	3.0	67.23
Alfalfa hay hay	89.05	27.63	72.37	17.3	24.0	2.70	28.37
Berseem hay	89.87	24.84	75.16	15.0	28.0	2.16	30.0
Dried Faba bean straw	90.73	18.42	81.58	8.0	32.0	1.52	40.06

Table (3): Effect of feeding experimental diets to growing V-line rabbits on productive performance

Parameter	Body weight (g / rabbit)		Body weight gain (g / rabbit)		Feed Intake (g / rabbit)		Feed conversion ratio (g. feed/ g. gain)	
	6 wks	12 wks	6-8 wks	Overall[1]	6-8 wks	Overall	6-8 wks	Overall
Treatment[2]								
1	1058.33	2659.55	584.17	1601.22	2053.75^{a}	5913.5^{a}	3.52^{a}	3.69^{a}
2	1066.67	2648.64	565.00	1581.57	1536.50^{e}	5085.3^{c}	2.72^{e}	3.22^{c}
3	1061.67	2634.17	562.50	1572.50	1562.00^{de}	4840.5^{c}	2.78^{de}	3.08^{c}
4	1063.33	2635.83	566.25	1572.50	1680.00^{c}	5088.3^{c}	2.97^{c}	3.24^{c}
5	1063.75	2633.18	554.58	1569.09	1624.00^{dc}	4901.5^{c}	2.93^{cd}	3.12^{c}
6	1064.58	2652.50	572.08	1587.92	1676.50^{c}	5094.8^{c}	2.93^{cd}	3.21^{c}
7	1066.67	2640.91	560.00	1574.09	1838.25^{b}	5460.0^{b}	3.29^{b}	3.47^{b}
SEM	8.80	19.92	17.18	17.54	24.79	94.65	0.05	0.06
Sex								
Male	1061.91	2646.34	571.67	1584.39	1727.29	5171.43	3.02	3.26
Female	1065.24	2640.38	561.07	1575.10	1693.00	5223.93	3.01	3.32
SEM	4.70	10.32	9.18	9.09	13.25	50.59	0.02	0.03
Probabilities								
Treatment	NS[*]	NS	NS	NS	***	***	***	***
Sex	NS	NS	NS	NS	NS	NS	NS	NS

[1]**Overall :** 6 to 12 weeks of age [2]**Treatments: 1**: Commercial diet: **2:** Barley with Alfalfa hay: **3:** Barley with Berseem hay: **4:** Barley with Faba beans straw: **5:** Corn-cob meal with Alfalfa hay: **6:** Corn-cob meal with Berseem hay: and **7:** Corn-cob meal with Faba beans straw. [*]**NS:** Non signifiant

Table (4): Effect of feeding experimental diets to growing V-line rabbits on nutrients intake per rabbit

Parameter	Feed Intake (g / rabbit)		Protein intake (g / rabbit)		Digestible Energy intake (k. cal / rabbit)		Fiber intake (g / rabbit)	
	6-8 wks	Overall[1]	6-8 wks	Overall	6-8 wks	Overall	6-8 wks	Overall
Treatment[2]								
1	2053.75[a]	5913.5[a]	395.42[a]	1034.88[a]	5298.80[a]	15257.09[a]	297.80[a]	857.47[a]
2	1536.50[e]	5085.3[c]	274.42[d]	908.23[cd]	4128.58[d]	13664.07[bc]	185.76[e]	614.81[d]
3	1562.00[de]	4840.5[c]	278.35[d]	862.58[d]	4176.79[d]	12943.50[c]	205.72[d]	637.50[d]
4	1680.00[c]	5088.3[c]	301.73[c]	913.86[cd]	4544.40[c]	13763.85[b]	227.81[c]	689.97[c]
5	1624.00[dc]	4901.5[c]	291.18[c]	878.82[cd]	4381.55[c]	13223.98[bc]	214.04[d]	646.01[d]
6	1676.50[c]	5094.8[c]	302.95[c]	920.60[c]	4550.02[c]	13826.74[b]	235.72[c]	716.30[c]
7	1838.25[b]	5460.0[b]	329.22[b]	977.89[b]	4948.44[b]	14698.32[a]	272.24[b]	808.63[b]
SEM	24.79	94.65	4.09	16.80	61.27	251.79	3.07	12.92
Sex								
Male	1727.285	5171.43	308.40	923.47	4621.95	13980.41	236.40	706.08
Female	1693.00	5223.93	302.24	932.77	4529.07	13841.78	231.91	714.12
SEM	13.25	50.59	2.18	8.98	32.75	134.59	1.64	6.90
Probabilities								
Treatment	***	***	***	***	***	***	***	***
Sex	NS	NS	NS	NS	NS	NS	NS	NS

[1]**Overall :** 6 to 12 weeks of age [2]**Treatments: 1:** Commercial diet; **2:** Barley with Alfalfa hay; **3:** Barley with Berseem hay; **4:** Barley with Faba beans straw; **5:** Corn-cob meal with Alfalfa hay; **6:** Corn-cob meal with Berseem hay; and **7:** Corn-cob meal with Faba beans straw. ***NS:** Non signifiant

Table (5): Effect of feeding experimental diets to growing V-line rabbits on slaughter traits

Parameter / Treatment[1]	Slaughter Traits, (%) LBW[1]	Dressing	Small intestine	Small intes. (cm)	Caecum	Caecum (cm)	Abdominal fat	Heart	Liver	Kidney	Spleen
1	2527.5	62.37^{b}	8.73^{ab}	310.25^{b}	3.25^{ab}	10.50^{c}	6.63^{abc}	3.02	11.05	4.66	1.31
2	2687.5	63.80^{bc}	9.29^{a}	283.50^{b}	3.80^{a}	13.38^{a}	7.92^{ab}	3.20	11.74	4.82	1.48
3	2728.8	65.67^{a}	8.24^{ab}	297.50^{b}	3.55^{ab}	12.00^{b}	7.94^{ab}	3.07	11.90	4.94	1.58
4	2633.8	64.51^{ab}	8.43^{ab}	301.25^{b}	3.60^{ab}	11.85^{b}	8.62^{a}	2.99	11.64	4.98	1.56
5	2618.8	63.01^{ab}	8.58^{ab}	362.50^{a}	3.11^{b}	11.25^{bc}	6.03^{bc}	3.20	11.75	4.64	1.31
6	2647.5	65.79^{a}	8.07^{b}	304.25^{b}	3.54^{ab}	11.75^{bc}	7.24^{abc}	2.89	10.73	4.60	1.40
7	2590.0	63.14^{ab}	8.56^{ab}	296.00^{b}	3.66^{ab}	12.00^{b}	5.73^{c}	2.89	10.95	4.31	1.25
SEM	113.27	0.85	0.35	13.05	0.17	0.44	0.64	0.10	0.42	0.18	0.10
Sex											
Male	2614.64	64.45	8.44	304.07	3.46	11.86	7.30	3.12	11.41	4.72	1.45
Female	2652.14	63.63	8.68	311.71	3.55	11.75	7.02	2.95	11.38	4.70	1.38
SEM	60.55	0.45	0.19	6.98	0.09	0.23	0.34	0.05	0.23	0.10	0.05
Probabilities											
Treatment	NS[3]	*	*	**	*	**	*	NS	NS	NS	NS
Sex	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

^{abc}: Letters in the same column with different superscripts are significantly different.
[1]**LBW:** Live body weights [2]**Treatments: 1**: Commercial diet; **2:** Barley with Alfalfa hay; **3:** Barley with Berseem hay; **4:** Barley with Faba beans straw; **5:** Corn-cob meal with Alfalfa hay; **6:** Corn-cob meal with Berseem hay; and **7:** Corn-cob meal with Faba beans straw.
[3]**NS** = Non significant. * = $P < 0.05$. ** = $P \leq 0.01$

Table (6): Effect of feeding experimental diets to growing V-line rabbits on nutrients digestion coefficients

Treatment[1]	Digestion coefficients %					
	DM	OM	CP	CF	EE	NFE
1	68.37[c]	70.26[c]	70.19[c]	38.80[d]	75.10[ab]	77.78[c]
2	72.50[b]	73.57[b]	70.19[c]	43.01[bc]	74.12[ab]	81.83[b]
3	72.41[b]	73.35[b]	73.20[bc]	42.40[c]	71.82[b]	81.86[b]
4	73.96[b]	74.42[b]	74.81[ab]	36.61[c]	74.42[ab]	84.41[ab]
5	77.75[a]	78.76[a]	75.94[ab]	49.64[a]	75.67[a]	87.56[a]
6	73.05[b]	74.17[b]	72.72[bc]	44.79[b]	72.83[ab]	83.59[b]
7	74.11[b]	74.74[b]	77.57[a]	39.99[d]	75.15[ab]	84.28[ab]
SEM	0.94	0.93	1.18	0.70	0.99	1.18
Probabilities	**	**	**	**	**	**

[abc]. Letters in the same column with different superscripts are significantly different.
[1]**LBW**: Live body weights [2]**Treatments: 1**: Commercial diet: **2:** Barley with Alfalfa hay: **3:** Barley with Berseem hay: **4:** Barley with Faba beans straw: **5:** Corn-cob meal with Alfalfa hay: **6:** Corn-cob meal with Berseem hay: and **7:** Corn-cob meal with Faba beans straw.
** $P < 0.01$

Table (7): Effect of feeding experimental diets to growing V-line rabbits on nutritive value

Treatment[1]	Nutritive Values		
	TDN %	DCP %	DE (k.cal / kg)
1	59.49[c]	12.63[c]	2635.56[c]
2	64.39[b]	12.53[c]	2852.33[b]
3	62.26[b]	13.04[bc]	2758.12[b]
4	64.41[b]	13.43[ab]	2853.36[b]
5	68.80[a]	13.62[ab]	3047.99[a]
6	63.09[b]	13.14[bc]	2794.89[b]
7	63.82[b]	13.89[a]	2827.22[b]
SEM	0.79	0.21	35.00
Probabilities	**	**	**

[abc]. Letters in the same column with different superscripts are significantly different. [1]LBW: Live body weights [2]**Treatments: 1**: Commercial diet: **2:** Barley with Alfalfa hay: **3:** Barley with Berseem hay: **4:** Barley with Faba beans straw: **5:** Corn-cob meal with Alfalfa hay: **6:** Corn-cob meal with Berseem hay: and **7:** Corn-cob meal with Faba beans straw. **=$P<0.01$

Table (8): Effect of feeding experimental diets to growing V-line rabbits on the relative economical efficiency

Parameter	Dietary treatments[1]						
	T1[1]	T2	T3	T4	T5	T6	T7
Average feed intake/rabbit (kg)	5.91	5.09	4.84	5.09	4.90	5.10	5.46
Price kg diet (L.E)	1.50	1.48	1.39	1.40	1.39	1.32	1.31
Total feed cost/rabbit (L.E)	8.87	7.53	6.73	7.13	6.81	6.73	7.15
Average body weight gain (kg)	1.600	1.580	1.573	1.573	1.569	1.588	1.574
Price kg body weight (L.E)	12	12	12	12	12	12	12
Selling price (L.E)	19.20	18.96	18.88	18.88	18.83	19.06	18.89
Net revenue (L.E)	10.33	11.43	12.15	11.75	12.02	12.33	11.74
Economical efficiency	1.16	1.52	1.80	1.65	1.77	1.83	1.64
Relative economical efficiency	100	131	155.2	142.2	152.6	157.8	141.4

[2]**Treatments: 1:** Commercial diet; **2:** Barley with Alfalfa hay; **3:** Barley with Berseem hay; **4:** Barley with Faba beans straw; **5:** Corn-cob meal with Alfalfa hay; **6:** Corn-cob meal with Berseem hay; and **7:** Corn-cob meal with Faba beans straw.

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الملخص العربي

الإستفادة من مخلوط الذرة بالقوالح، تبن الفول فى اعلاف الأرانب النامية وتأثيرهما على الأداء الإنتاجى ، معاملات الهضم و الكفاء الإقتصادية

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استخدم ٨٤ أرنب نامي من سلالة V-Line بعد الفطام على عمر ٦ أسابيع بعد توزيعها بشكل عشوائي في ٧ مجموعات تجريبية استهدفت التقييم الغذائى لكل من الشعير ، مخلوط الذرة بالقوالح ، مجفف البرسيم الحجازى ، البرسيم المصرى و تبن الفول. اشتمل التقييم على التحليل الكيماوى فضلا عن دراسة تأثير استبدال مخلوط الذرة بالقوالح فى العلائق بنسبة ٣٠ % بدلا من الشعير كمصدر للطاقة ، مع أى من مجفف البرسيم الحجازى أو البرسيم المصرى أو تبن الفول بدون القرون كل على حده بنسبة ٢٥ % كمصدر للألياف فى علائق الأرانب النامية على الاداء الانتاجى ، صفات الذبيحة ، معاملات هضم المركبات الغذائية و الكفاءة الإقتصادية .احتوت كل مجموعة ١٢ أرنب ، فى ٤ مكررات بكل منها ٣ ارانب. استمرت التجربة من ٦ إلى ١٢ أسبوعا من العمر . ويمكن تلخيص النتائج على النحو التالي :

١ – امكانية استعمال مخلوط الذرة بالقوالح كمصدر للطاقة؛ وذلك نتيجة لارتفاع محتواه من الكربوهيدرات الذائبة والدهن الخام، في حين كان البرسيم الحجازى أعلى فى محتواه من البروتين الخام والدهن و تلاه البرسيم المصرى. من ناحية اخرى كان محتوى الألياف الخام فى تبن الفول عاليا و عليه يمكن استخدامه كمصدر جيد للألياف.

٢ – لوحظ أعلى إستهلاك للعلف فى مجموعة الكنترول فى حين كان استهلاك العلف منخفضا فى باقى المعاملات والذي انخفض بنسبة ١٣.٨٤ إلى ١٨.١٤٪ فى المتوسط مقارنة بالكنترول. انخفضت نسبة التحويل الغذائى (٣.٦٩) نتيجة للتغذية على الكنترول، بينما تحسنت الكفاءة التحويلية للغذاء لجميع المعاملات الأخرى (٣.١٧ فى المتوسط) .

٣ – لوحظ ارتفاع استهلاك البروتين و الطاقة و الألياف فى عليقة الكنترول، بينما كان إستهلاك الطاقة فى عليقة الكنترول مماثلا للعليقة المحتوية على مخلوط الذرة بالقوالح مع تبن الفول .

٤ – انخفض دهن البطن (٥.٧٣%) فى الأرانب المغذاة على مخلوط الذرة بالقوالح مع تبن الفول، في حين سجلت أعلى نسبة لدهن البطن (٨.٦٢%) فى الأرانب المغذاة على الشعير مع تبن الفول. وكان أكبر طول للأمعاء الدقيقة للأرانب المغذاة على مخلوط الذرة بالقوالح مع الدريس (٣٦٢.٥ سم)، وأيضا أكبر طول للأعور للحيوانات المغذاة على الشعير مع الدريس (١٣.٣٨ سم) . ٥ – تراوح معامل هضم المادة الجافة ما بين ٦٨.٣٧ إلى ٧٧.٧٥ ٪ ، والمادة العضوية بين ٧٠.٢٦ إلى ٧٨.٧٦ ٪. أدى تغذية الأرانب على مخلوط الذرة بالقوالح مع تبن الفول الى زيادة كبيرة في معامل هضم البروتين (١٠.٥١ ٪ مقارنة بالكنترول) وايضا بالنسبة لجميع المعاملات الأخرى. أعطت الأرانب المغذاه على مخلوط الذرو بالقوالح مع الدريس أعلى معامل هضم الياف (٢٧.٩٤ ٪) و أعلى معامل هضم للدهون (٧٥.٦٧ %) .

٦ – أدى تغذية الأرانب على العليقة المحتوية على مخلوط الذرة بالقوالح مع الدريس الى زيادة معامل هضم الكربوهيدرات الذائبة بنسبة ١٢.٥٧ ، ٧.٠٠ ، ٦.٩٦ و ٤.٧٥ ٪ مقارنة بالكنترول والعلائق المحتوية على الشعير مع الدريس، الشعير مع البرسيم المصرى، مخلوط الذرة بالقوالح مع البرسيم المصرى على التوالي. وسجل أعلى معدل للمركبات المهضومة الكلية فى العليقة المحتوية على مخلوط الذرة بالقوالح مع الدريس (٦٨.٨ ٪). كذلك كان أعلى مستوى للبروتين الخام المهضوم فى العليقة المحتوية على مخلوط الذرة بالقوالح مع تبن الفول. كما كانت أعلى قيمة للطاقة المهضومة (٣٠٤٨ كيلو كالوري / كجم).

٧ – سجل أعلى صافي للربح وأعلى كفاءة اقتصادية نسبية فى العليقة المحتوية على مخلوط الذرة بالقوالح مع البرسيم المصرى ثم العليقة المحتوية على الشعير مع البرسيم المصرى وأخيرا العليقة المحتوية على مخلوط الذرة بالقوالح مع الدريس، بينما تفوقت جميع المعاملات مقارنة بالكنترول.

ومما سبق يمكن استخدام تبن الفول كمصدر الألياف بديلا عن البرسيم المجفف ومخلوط الذرة بالقوالح كمصدر للطاقة بديلا عن الشعير فى علائق الأرانب النامية دون أي تأثير سلبي على الأداء الإنتاجي أو صفات الذبيحة. فضلا عن ذلك فان هذه العناصر يمكن أن تعظم من خفض تكاليف التغذية والتي يمكن أن تنعكس على الكفاءة الإقتصادية للإنتاج.