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# PERFORMANCE OF GROWING RABBITS FEDDIETS CONTAINING FENNEL SEED MEAL WITHOUT OR WITH ENZYME MIXTURE.

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## ABSTRACT

*This study was carried out to evaluate the effect of substitution with fennel seed meal (FSM)instead of clover hay in rabbit diets supplemented without or with enzyme mixture(Natuzy meat rate of 0.35 g/ kg diet)on growing rabbit performance, digestion coefficient, carcass traits, blood parameters and economic efficiency. Seventy five APRI weaned rabbits (six weeks old, with average initial weight 697.7 ± 11.20 g)were randomly assigned to five groups, each had 5 replicates of 3 rabbits. The growth trail lasted for 8 weeks. Experimental diets were as follows; 1- A control, 2 and 3 were 20% and 40% FSM instead of clover hay without enzyme mixture,4 and 520% or 40% FSM instead of clover hay with enzyme( Natuzy meat rate of 0.35 g/ kg diet), respectively.*

***Results could be summarized as follows:***

1- *Final body weight, daily weight gain and feed conversion ratio were not differed significantly between the control and 20 or 40% FSM with enzyme. Also, increasing FSM level of the diet without enzyme supplementation results in gradual decrease in values of the corresponding variables, as well as, carcass and dressing percentages. Daily feed intake was not significantly affected by dietary treatments. Feed conversion was significantly improved with feeding rabbits on control and FSM with enzyme diets compared with those fed 40% FSM without enzyme. Digestion coefficients of crude protein, crude fiber, ether extract, nitrogen free extract and nutritive*

*value in terms of DCP, TDN and DE did not significantly differed between the control and 20 or 40 % FSM with enzyme diets.*

*2- Serum total protein, albumin and creatinine values did not significantly differed between groups. However, values of serum globulin, AST, ALT and total cholesterol were significantly affected by dietary treatments without clear trend. However, the control group consistently gave higher values.*

*3- Net monetary return was increased with feeding rabbits on diets containing fennel seed meal (FSM) with enzyme.*

***Conclusively**, it is concluded that fennel seed meal can be used in growing rabbit diets up to 10.8% of the diet (40% replacement from clover hay) with Natuzyme fortified enzyme to reduce feed costs without adverse effects on growth performance of rabbits.*

**Keywords:** Rabbits, Fennel seed meal, *Natuzyme* enzyme.

Nutrition has significant effects on the cost of production and the end product quality in livestock production. Accordingly, livestock nutritionists search every time to reduce production cost and keeping on the product quality. Many studies tried to find alternative sources to replace alfalfa hay which represent around 30-35% from formula of rabbits. Most of these alternative sources are by-products of medicinal plants such as mint, fennel, basil and anise. These herbs are produced by huge amount in Egypt. Fennel plant is cultivated around 2143feddan per year (Egyptian Ministry of Agriculture,2014). Its seed contains 2-6% volatile oil which is used in human feed additive for flavor. Fennel seed meal is a by-product of oil extraction and contains both seeds and stem. In this respect, Radwan and Khalil (2002)found that feeding growing rabbit on fennel hay (a by-product, after yielding fennel grains) at levels 34 or 50% of the diet improved nutrients digestion, growth performance and dressing percentage. Furthermore, the addition of fennel straw at a rate of10-15% of the diet showed stimulatory properties of digestion in lactating cows (Grela and Kowalczuk, 2007).

Supplementing enzyme mixture could support the endogenous enzymes of the poultry and rabbits, breaking down some components of cell wall, which cannot be broken down into absorbable nutrients by

endogenous enzymes (Tawfeek, 1996), lowering the gastrointestinal viscosity in digestive tract (Simon, 2000), reducing nutrient entrapment and releasing other nutrients like minerals (Al-Harthi *et al.*, 2009). As a support of these findings, El-Manylawi and El-Banna (2013)studied the effect of replacing 10 and 20% date stone meal in rabbits diet without or with adding Allzyme® SSF (containing: Phytase, beta-glucanase, celluase, pectinase, protease and xylanase) at a level of 0.02 % and concluded that the growth performance and nutrient digestibilities were increased in groups fed 10% date stone meal with enzyme compared to the other tested diets(10 or 20% date stone meal without enzyme)and the control.

Therefore, that study was designed to evaluate the inclusion of fennel seed meal (FSM)instead of clover hay without or with enzyme mixture on performance of growing rabbit.

## MATERIALS AND METHODS

The experiment was carried out at Kafr EL-Sheikh station belonging to Animal Production Research Institute, Agricultural Research Center. Fennel seed meal were obtained after oil extraction from rendering company and analyzed for dry matter, crude protein, crude fiber and Ash according to AOAC (2000) methods. Also, digestible energy (DE, Kcal/g)was calculated according to Cheeke (1987) as follows:

$$DE\ (kcal / g) = 4.36-(0.0491\times NDF\%),$$

Where $NDF\% = 28.924+(0.657\times CF\%)$.

### *Animals and experimental procedure*

A total of seventy five APRI weaned rabbits (six weeks old; averaging 697.7 g ± 11.20) were divided into five groups in 5 replicates, each has 3 rabbits. The animals were allocated to 5 diets treatments (Table 1) for 8 weeks. The control group was fed basal diet without fennel seed meal (FSM), while groups 2 and 3were fed diets with a replacement of clover hay by 20 or 40% of FSM being 5.4% and 10.8% of whole diet , respectively and groups 4 and 5 were fed as in groups 2 and 3 but with enzyme(*Natuzyme* at level of 0. 35g/kg diet). All diets were nearly iso-nutrigenous (17.50 % CP) and *iso-caloritic* (2540 kcal /kg) which covered the requirement of growing rabbits according to Agriculture Ministry

Decree (1996). Rabbits had access to feed (pellet form) and water *ad libitum* and housed in wire batteries in an open and good ventilation system. Live body weight and feed intake of rabbits were measured every week during the experimental period. Whereas, daily weight gain (g) and feed conversion ratio was calculated. At the end of the experimental period, a digestibility trial was conducted by using 5 rabbits / treatment to determine the digestibility coefficient of the nutrients according to Fekete (1985). Feed and dried feces were analyzed according to (AOAC,2000). In addition, 5 animals from each group were slaughtered to evaluate carcass characteristics. Studied traits involved hot carcass, liver, kidneys, heart and giblets as a percentage of live body weight. Moreover, dressing percentage were calculated according to Steven *et al*. (1981).Blood samples were taken from rabbits assigned to slaughter and centrifuged at the speed of 4000 rpm for 15 min. Sera were stored at -20°C till biochemical analysis for total protein; u/l (Gornal *et al*., 1949), albumin; u/l (Doumas and Waston, 1971), globulin was calculated by subtraction of serum albumin from total serum protein. Moreover, AST, aspartate aminotransferase; u/land ALT, alanine aminotransferase; u/l (Reitman and Frankel, 1957**)**, total cholesterol; mg⁄dl (Richmond, 1973) and creatinine; mg⁄dl (Schirmeister, 1964).

***Economical efficiency:***

The economical efficiency (EEF) was calculated according to the following equation: EEF = Net revenue / total costs. Where the total cost prices by Egyptian pound (LE) based on local market at the time of experiment.

***Statistical analysis***

All data were subjected to analysis of variance using the GLM procedure of SAS (2004) by the following model:

$$Y_{ij} = \mu + T_i + e_{ij},$$

Where: $\mu$= overall mean of $Y_{ij}$, T = effect of treatment, i = (1, 2, 5) and $e_{ij}$= experimental error.

**Table (1).** Ingredients and chemical composition of experimental diets**.**

| **Ingredients** | **Control** | **FSM With enzyme, %** | | **FSM Without enzyme, %** | |
|---|---|---|---|---|---|
| | | **20** | **40** | **20** | **40** |
| Clover hay (12%) | 27.00 | 21.60 | 16.20 | 21.60 | 16.20 |
| Fennel seed meal (FSM) | --------- | 5.40 | 10.80 | 5.40 | 10.80 |
| Wheat bran | 27.00 | 27.00 | 27.00 | 27.00 | 27.00 |
| Yellow corn | 19.90 | 19.90 | 19.90 | 19.90 | 19.90 |
| Soybean meal (44% ) | 19.40 | 19.40 | 19.40 | 19.40 | 19.40 |
| Molasses | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Di calcium phosphate | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Sodium chloride (NaCl) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Vit.& min. mix[1] | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Limestone | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| DL-Methionine | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| Anticoccidia (Diclazuril) | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| **Total** | **100** | **100** | **100** | **100** | **100** |
| ***Calculated analysis , %[2]*** | | | | | |
| Crude protein | 17.69 | 17.62 | 17.55 | 17.62 | 17.55 |
| Crude fiber | 12.94 | 12.78 | 12.62 | 12.78 | 12.62 |
| Ether extract | 2.69 | 2.74 | 2.78 | 2.74 | 2.78 |
| Nitrogen free extract | 56.02 | 56.49 | 56.60 | 56.52 | 56.73 |
| Ash | 10.66 | 10.37 | 10.45 | 10.34 | 10.32 |
| Digestible energy ( kcal/ kg) | 2527.8 | 2543.3 | 2558.8 | 2543. 3 | 2558.8 |
| Calcium | 1.20 | 1.22 | 1.25 | 1.22 | 1.25 |
| Total phosphorus | 0.868 | 0.873 | 0.878 | 0.873 | 0.878 |
| Lysine | 0.939 | 0.935 | 0.932 | 0.935 | 0.932 |
| Methonine | 0.623 | 0.621 | 0.621 | 0.621 | 0.621 |

[1]Each 3 kg of vitamins and minerals mixture contains: Vit. A 6.000.000 IU, Vit.$B_1$2000mg, Vit.$B_2$4000mg, Vit.$D_3$9.00.000 IU, Vit E 40000mg, Vit. $K_3$2000 mg, Pantothenic acid 10.000mg; Nicotinic acid, 50000g; Vit. $B_6$2000mg; Vit. $B_{12}$10 mg, Folic acid 3000mg, Biotin 50 mg, Cu 5g, choline 250g,Mn8.5g, Fe 50g, , Co 0.1 g, Se 0.1 g, Zn 50 g,Iodine0.2 g .

[2]According to Feed composition for Animal and Poultry Feedstuff used in Egypt (2001).

FSM: fennel seed meal

The significant differences between treatment means were separated using Duncan's multiple range test (1955).

## RESULTS AND DISCUSSION

***Approximate analysis of fennel seed meal:***

Chemical composition of fennel hay (by-product, after yielding fennel grains) is known to show variation due to difference between varieties and growing condition (Hussien, 1981). Chemical composition of fennel seed meal was close to that of clover hay as presented in Table 2. The results show that fennel seed meal (FSM), in comparison to the clover hay could be recommended as a good alternative, where it contained close crude protein content (10.7*vs.*12.0%), crude fiber (27.04*vs.* 30.00%), ether extract (2.91*vs.*2.10%) and NFE content (47.14*vs.* 47.10%),While FSM show higher digestible energy (2067.5 kcal/kg) than clover hay (1780kcal/kg). The chemical composition of fennel seed meal has near by trend to that reported by Radwan and Khalil (2002) who found that fennel hay contain 12.3% CP, 1.8% EE, 14% CF, 50.8%NFE and 12.6% Ash. On the other hand, FSM recorded higher nutritive values than its straw as documented by Mohammed (2009) who found that fennel straw contains 5% CP, 34.4 % CF, 1.9% EE and 10.7% Ash.

**Table 2.** Chemical composition of fennel seed meal (FSM) and Clover hay (on DM basis).

| Items | **OM%** | **CP%** | **CF%** | **EE%** | **NFE%** | **Ash%** | **DE (Kcal/kg)** |
|---|---|---|---|---|---|---|---|
| FSM[1] | 87.79 | 10.70 | 27.04 | 2.91 | 47.14 | 12.21 | 2067.5[3] |
| Clover hay[2] | 91.20 | 12.00 | 30.00 | 2.10 | 47.10 | 8.80 | 1780 |

1: FSM: Fennel seed meal,

2: Chemical analysis was recorded based on Feed Composition for Animal and poultry Feedstuff used in Egypt (2001).

3: DE (kcal/g) = 4.36 – (0.0491× NDF %), Where NDF% = 28.924+(0.657× CF%)according to Cheeke (1987).

***Growth performance***

Effect of different treatments on rabbit's growth performance is listed in Table 3. Final body weight and daily weight gain were significantly ($P<0.01$)higher in rabbits fed on control diet and those fed diets with 20%FSM with enzyme than other groups fed 40% FSM without enzyme, while without significant differences to rabbits fed 40% FSM with enzyme compared with control group. On the other hand, final live body weight and daily weight gain were significantly decreased with 20 or40% FSM diet compared with control diet. The growth promoting effect of enzymes was reported earlier El-Manylawi and El-Banna (2013)indicated that date stone meal can be incorporated in rabbit diets at level of 10% plus when fortified with Allzyme® SSF (enzyme mixture) to achieve good growth performance comparable to control group. Radwan and Khalil (2002) evaluated of fennel hay in growing rabbit diets at level of 34 or 50% and they showed an improvement in growth performance compared with control group. In current study, the enhancement in growth performance may be due to that enzyme mixture (*Natuzyme*) contains a variety of enzymes especially cellulase which broke down some components of cell wall in FSM, while protease improved protein utilization and consequently support weight gain of rabbits (Tawfeek,1996).In addition to β- mannanase which reduce intestinal viscosity (Lee *et al.,* 2003), enhance growth (Gharaei *et al.,* 2012). Eiben *et al*. (2004) found that weight gain of rabbits were significantly improved by supplement their diets with cellulase enzyme. Also, Garcia-Palomares *et al.* (2006) and Garcia-Ruiz *et al.* (2006) showed that supplementation with mixture of enzymes (beta-glucanase, beta-xylanase, alpha-amylase and pectinase) improved growth rate of fattening rabbits.

Feed intake for different groups did not significantly affected by any tested diets. It is indicated that aromatic nature of this medicinal plant did not influence the palatability of the diet. In this respect, Radwan and Khalil(2002)found that rabbit diet contained different levels of fennel hay (0, 17, 34 and 50%) did not affect feed intake values. Regarding to feed conversion ratio, the groups of 20% FSM with enzyme, control and 40%FSM with enzyme recorded better values without significant differences to group of 20% FSM without enzyme and, with significant variation to group of 40% FSM without enzyme. Results are in accordance with the earlier research of Garcia-Palomares *et al.* (2006) and Garcia-Ruiz *et al.* (2006) who concluded

**Table 3.** Growth performance of growing rabbits fed on different experimental diets.

| Items (g) | Control | FSM With enzyme, % | | FSM Without enzyme,% | | SEM |
|---|---|---|---|---|---|---|
| | | 20 | 40 | 20 | 40 | |
| Initial body weight | 695.00 | 696.67 | 695.00 | 702.67 | 700.00 | 11.20 |
| Final body weight | 1760[a] | 1758[a] | 1701[ab] | 1622[b] | 1501[c] | 30.30 |
| Daily body weight gain | 19.01[a] | 18.95[a] | 17.96[ab] | 16.41[b] | 14.30[c] | 0.52 |
| Daily feed intake | 73.66 | 70.73 | 69.89 | 73.24 | 68.37 | 2.20 |
| Feed convers ion ratio (g feed/ g gain) | 3.87[b] | 3.73[b] | 3.89[b] | 4.46[ab] | 4.78[a] | 0.14 |

a,b and c--- Means in the same row with different superscripts are significantly different.
. FSM: fennel seed meal

Glucanase and endo 1-4 beta xylanase) compared to untreated group. that adding enzyme mixture (protease and xylanase) to growing rabbit diet enhanced their FCR compared to control. In broiler chickens, Oladunjoye and Ojebiyi (2010) observed better FCR in chicks fed diet contained rice bran supplemented with Roxazyme (endo 1-4 beta glucanase , endo 1-3 beta**.**

***Nutrients digestibility and Nutritive values***

Results in Table 4 indicate that there were no significant differences in digestion coefficients of dry matter (DM) and organic matter (OM) between rabbit fed different experimental diets. The control group recorded higher digestibility coefficient of CP, CF, EE and NFE without significant differences to groups of either 20% or 40% FSM with enzyme. But, the former group (control) achieved significantly higher digestibilities values of CP, CF, EE and NFE in comparison to 20% or 40%FSMwithout enzyme.

Regarding to nutritive values, rabbits fed control diet show higher DCP and TDN values without significant differences to other groups fed either 20% or 40% FSM with enzyme. However, groups of 20% and 40% FSM without enzyme were significantly decreased values of DCP and TDN compared with control. However, groups of 40% FSM with enzyme and 20 or 40% FSM without enzyme were significantly decreased of DE compared with control group. These results are in accordance with the findings of **El-**Manylawi and El-Banna (2013)who showed that adding Allzyme® SSF to the rabbit's diets containing 10 or 20% date stone meal resulted insignificantly increased in the digestibility of EE and NFE compared to the other tested diets

**Table 4.** Digestion coefficient and nutritive values of growing rabbits fed experimental diets.

| Items | Control | FSM With enzyme, % | | FSM Without enzyme,% | | SEM |
|---|---|---|---|---|---|---|
| | | 20 | 40 | 20 | 40 | |
| ***Digestion coefficient*** | 65.21 | 65.33 | 62.40 | 62.54 | 60.24 | 1.51 |
| Dry Matter | 66.40 | 64.78 | 64.66 | 63.50 | 59.07 | 2.44 |
| Organic Matter | $75.00^{a}$ | $73.46^{a}$ | $70.44^{ab}$ | $68.39^{b}$ | $60.48^{c}$ | 1.47 |
| Crude Protein | $35.59^{a}$ | $34.70^{a}$ | $34.55^{a}$ | $31.00^{b}$ | $28.45^{b}$ | 0.82 |
| Crude Fiber | $80.45^{a}$ | $81.51^{a}$ | $78.43^{ab}$ | $75.68^{bc}$ | $73.62^{c}$ | 0.86 |
| Ether Extract | $72.54^{a}$ | $70.28^{ab}$ | $69.67^{ab}$ | $68.43^{bc}$ | $65.65^{c}$ | 0.71 |
| Nitrogen Free Extract | | | | | | |
| ***Nutritive values*** | $13.17^{a}$ | $12.84^{ab}$ | $12.25^{ab}$ | $11.96^{b}$ | $10.52^{c}$ | 0.27 |
| DCP | $60.37^{a}$ | $58.63^{ab}$ | $58.04^{ab}$ | $56.42^{b}$ | $55.76^{c}$ | 0.40 |
| TDN | $2674.3^{a}$ | $2597.3^{ab}$ | $2571.1^{b}$ | $2499.4^{bc}$ | $2470.1^{c}$ | 22.46 |
| DE (kcal/kg)* | 65.21 | 65.33 | 62.40 | 62.54 | 60.24 | 1.51 |

a,b, and c--- Means in the same row with different superscripts are significantly different.
*DE (kcal/ kg) = TDN × 44.3 according to **(Schneider and Flatt, 1975).**
FSM: fennel seed meal

included the control. In this concoction, Ogunsipe (2014) confirmed the importance of adding exogenous enzymes to rabbit diet to deal with high content of non starch polysaccharides in diets. Radwan and Khalil (2002) found that digestion coefficient values of CF and EE were significantly improved by including fennel hay meal at levels of 34 or 50% in rabbit diets, They also, noted that OM, CP and NFE digestibilities were insignificantly difference between groups. The enhancement in all digestion coefficient and nutritive values in enzyme supplemented groups may be due to many reasons: firstly, promoting the growth of useful bacteria in the gut (Kholif *et al.*, 2005 and Viveros*et al.*, 1993). Secondly, decrease the viscosity of digestive content in the small intestine as a result of hydrolyzing part of none starch polysaccharides; NSP (Arabinoxylans which are the main NSP in wheat bran) as documented by Bedford and Classen (1992**)**.Thirdly, by reducing NSP, the gut flora modified then decreasing fermentation in the small intestine and improve nutrient utilization (Choct *et al.*, 1999).

***Carcass* traits**

Carcass characteristics at 14 weeks of age of rabbits are presented in Table 5. The obtained results show that inclusion of 20 or 40%FSMwithenzyme led to significant differences in carcass and dressing percentages compared to the 40% FSP group without enzyme. On the other hand, there were significantly decreased in values of carcass and dressing percentages with 40% FSM without enzyme compared with control group. However, there were no significant differences with rabbits fed control diet. On contrary, the rest of measurements including liver, kidney, heart and giblets percentages did not influenced by tested treatments. Radwan and Khalil (2002) found that dressing percentage of rabbits fed fennel hay meal at levels 34 or 50% improved with increasing fennel hay meal levelwithout holding significant differences in liver and heart percentages. Also, El-Manylawi and El-Banna(2013) showed that incorporation of date stone meal at levels 10 or 20% without or with Allzyme® SSF in rabbit diets, led to insignificant decrease in dressing percentage compared to the control.

**Table 5.Carcass traits of growing rabbits fed on experimental diets.**

| Items | Control | FSM With enzyme, % | | FSM Without enzyme,% | | SEM |
|---|---|---|---|---|---|---|
| | | 20 | 40 | 20 | 40 | |
| Carcass | 53.31[a] | 53.19[a] | 52.32[a] | 51.92[a] | 49.65[b] | 0.52 |
| Dressing | 58.03[a] | 57.88[a] | 56.95[a] | 56.49[ab] | 53.98[b] | 0.50 |
| Liver | 3.70 | 3.67 | 3.63 | 3.57 | 3.47 | 0.32 |
| Kidney | 0.645 | 0.641 | 0.632 | 0.627 | 0.534 | 0.19 |
| Heart | 0.382 | 0.382 | 0.377 | 0.375 | 0.333 | 0.11 |
| Giblets | 53.31[a] | 4.69 | 4.63 | 4.57 | 4.33 | 0.08 |

a and b---- Means in the same row with different superscripts are significantly different.

FSM: Fennel seed meal

***Blood constituents***

Blood serum concentration values of total protein, albumin, globulin, aspartate aminotransferase (AST) alanine aminotransferase (ALT), creatinine and total cholesterol are shown in Table 6.It is worthy to note that the obtained values of blood parameters were within the normal range. It could be noticed serum total protein, albumin and creatinine values did not significantly differed between tested groups .However, serum globulin values were insignificantly high in control and groups of 20% FSM either without or with enzyme.

**Table 6.** Blood constitutes of growing rabbits fed on experimental diets**.**

| Items | Control | FSM With enzyme, % | | FSM Without enzyme,% | | SEM |
|---|---|---|---|---|---|---|
| | | 20 | 40 | 20 | 40 | |
| Total protein ( g/dl) | 6.20 | 5.63 | 5.53 | 5.33 | 5.07 | 0.24 |
| Albumin ( g/dl) | 3.76 | 3.56 | 3.55 | 3.26 | 3.16 | 0.11 |
| Globulin ( g/dl) | 2.44[a] | 2.07[ab] | 1.97[b] | 2.07[ab] | 1.91[b] | 0.07 |
| AST(U/L) | 45.43[a] | 42.70[a] | 41.30[ab] | 37.70[ab] | 34.30[b] | 1.41 |
| ALT(U/L) | 55.70[a] | 49.92[ab] | 53.83[a] | 47.73[b] | 47.96[b] | 1.03 |
| Creatinine (mg/ dl) | 1.57 | 1.48 | 1.46 | 1.30 | 1.22 | 0.09 |
| Total cholesterol (mg/ dl) | 102.81[a] | 84.47[b] | 78.85[b] | 90.50[ab] | 81.47[b] | 3.13 |

a, and b-- Means in the same row with different superscripts are significantly different
FSM: Fennel seed meal

Rabbits fed control diet recorded higher AST values without significant differences to other group of 20% FSM without enzyme and groups supplemented with enzyme either with 20% or 40% FSM.

Moreover, the three groups of control, 20% and 40% FSM with enzyme recorded insignificant high ALT values while, groups of 20% or 40% FSM without enzyme recorded significantly lower rate of ALT compared to control. Oloruntola and Ayodele (2017) reported that ALT value reduced significantly in rabbits fed 10% Pawpaw leaf meal with multi enzyme supplementation at rate of 0.5 g ⁄ kg. In contrary, Tawfeek(1996) found that supplementation of Kemzyme (xylanase, betaglucanase, cellulose, amylase and protease) in rabbits diet increased AST level. Total serum cholesterol was significantly lower in groups of 40% FSM without enzyme and 20% or 40% FSM with enzyme compared to control group but without significant differences with 20% FSM without enzyme compared with control group. Reduction of cholesterol level recorded in this study may be due to activities of essential oil residues present in fennel seeds which has very strong antioxidant properties (Ruberto *et al*., 2000).

***Economical efficiency***

Results illustrated in Table 7 show that economical efficiency was improved in 20% or 40% FSM with enzyme while, was decreased in groups of 20% and 40% without enzyme rather than control. These results are in agreement with the results of El- Manylawi and El-Banna (2013) who

**Table7.** Economical Efficiency of growing rabbits fed experimental diets.

| **Items** | **Control** | **FSM With enzyme, %** | | **FSM Without enzyme,%** | |
|---|---|---|---|---|---|
| | | **20** | **40** | **20** | **40** |
| Total average weight(g) | 1064 | 1061.2 | 1005.7 | 918.96 | 800.80 |
| Selling price/rabbit (LE) (A) | 52.13 | 51.99 | 49.27 | 45.02 | 39.23 |
| Total feed intake | 4.124 | 3.960 | 3.913 | 4.101 | 3.828 |
| Price/kg feed(LE) | 4.45 | 4.42 | 4.35 | 4.34 | 4.28 |
| Total feed cost/rabbit (LE), (B) | 18.35 | 17.50 | 17.02 | 17.79 | 16.38 |
| Net revenue(LE)[1] | 33.78 | 34.49 | 32.25 | 27.23 | 22.85 |
| Economic efficiency[2] | 1.84 | 1.97 | 1.89 | 1.53 | 1.39 |
| Relative Econ. Eff.[3] | 100 | 107.06 | 102.71 | 83.15 | 75.54 |

Price of 1 kg live body weight = 49 LE

(1) Net revenue = A – B.

(2) Economic efficiency = (A-B/B).

(3) Relative Economic Efficiency= Economic efficiency of treatments other than the control/ Economic efficiency of the control group.

FSM: Fennel seed meal

reported that adding Allzyme® SSF in rabbit diets containing 10% date stone meal achieved good economical efficiency compared to control group. In opposite, Radwan and Khalil (2002) found that economical efficiency values were increased by increasing fennel hay meal levels in rabbit diets.

***Conclusively***, it could be concluded that the fennel seed meal can be used in growing rabbit diets up to 40% as replacing of clover hat with enzyme without harmful effects on performance of rabbits and healthy condition as well as its beneficial effect on feed cost and economical efficiency.

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## الأداء الأنتاجى للأرانب النامية المغذاة على علائق تحتوى على كسب الشمر بدون أو مع أضافة مخلوطالأنزيم .

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أجريت هذة الدراسة لتقييم تأثير إستخدام كسب الشمرإحلال من دريس البرسيم بدون أو مع اضافة مخلوطالأنزيم (ناتوزيم ) على الأداء الأنتاجى للأرانب النامية معاملات الهضم

,صفات الذبيحة, قياسات الدم والكفاءة الأقتصادية. تم تقسيم ٧٥ أرنب أبرى مفطوم عمر ٦ أسابيع عشوائيا بمتوسط وزن٦٩٧,٧ ± ١١,٢٠ الى ٥ مجموعات بها ٥ مكررات بكل منها ٣ ارنب وكانت العلائق التجريبية كالتالى: ١- كنترول ,الثانية والثالثة ٢٠%, ٤٠% كسب الشمر بدلا عن الدريس بدون اضافة الانزيم الرابعة والخامسة ٢٠% و ٤٠% كسبالشمر بدلا عن الدريس مع اضافة الانزيم (ناتوزيم بمعدل ٠.٣٥ جرام/ كجم علف) على التوالى.

**ويمكن تلخيص النتائج كالتالى :**

١ - لايوجد فرق معنوى فى كلا من وزن الجسم النهائى والزيادة اليومية فى وزن الجسم وكفاءة التحويل الغذائى ونسبة الذبيحة والاجزاء الكلية المأكولة بين مجموعة الكنترول والمجموعتين التى تغذتا على ٢٠ أو ٤٠% كسب الشمر مع أضافة الأنزيموأيضا انخفضت تدريجيا قيم المقاييس السابقة بزيادة نسبة الأحلال بدون أضافة الأنزيم فى العلائق.

٢- وجد تأيثر غير معنوى فى الغذاء المأكول اليومى بين المعاملات.وجد تحسن فى معامل التحويل الغذائى مع التغذية على عليقة الكنترولوكسب الشمرمع أضافة الأنزيم مقارنة ب ٤٠% بدون أضافة الأنزيم.وجد فرق غير معنوى فى معاملات الهضم بين عليقةالكنترول و علائق٢٠ أو ٤٠% تفل الشمر مع الأنزيم لكلا من البروتين الخام ,الألياف الخام والدهن الخام والمستخلص الخالى من الأزوت والقيم الغذائية الممثلة فى المهضوم من البروتين ,المركبات الكلية والطاقة المهضومة.لايوجد فرق معنوى فى قيم بروتين الدم الكلى ,الالبيومين و الكرياتنين بين المجموعات المختبرة .ولكن وجد فرق معنوى فى الجليبولين AST ,ALT والكولسترول الكلى مع المعاملات ولكن أعطت مجموعة الكنترول أعلى القيم.

٣- وجد زيادة العائد المادى عند التغذية على ٢٠ او ٤٠ % كسب شمر مع وجود مخلوط الأنزيم.

**التوصية:** يمكن أستخدام كسب الشمر حتى مستوى ١٠,٨ % من العليقة (٤٠ % إحلال من دريس البرسيم) مع الانزيم فى علائق الأرانب النامية والتى أدت الى خفض التكلفة الاقتصادية للعلائق بدون أى تأثير سلبى على الأداء الانتاجى للأرانب.

الكلمات الدالة: الأرانب ,كسب الشمر ,أنزيم ناتوزيم.