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EVALUATION OF SPROUTED BARLEY IN RABBIT DIETS

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ABSTRACT

This study aimed to evaluate the effects of partial replacement of concentrate feed mixture by sprouted barley on bedding of rice straw and using the product either fresh or silage in growing New Zealand White rabbits, (NZW) diet. Twenty one males (NZW) rabbits of 7 weeks old weighing 1086 to 1091 g on average were divided into 3 equal groups (7 rabbits each) according to their weights. Rabbits were given three diets being a commercial basal pelleted diet alone (concentrate feed mixture 100 %) as a control (G1), while the other two groups were offered 70 % of the control diet and free consumption from sprouted barley either fresh (G2) or silage (G3) for 7 weeks (experimental period). The effects of the experimental diets on digestibility, feeding value, growth performance, carcass traits and economic growth efficiency were studied.

Results indicated that digestibility of OM, CP and NFE showed the highest value with G3 compared with those fed control (G1) and G2 diets without significant differences. While, EE and CF digestibility were the highest values with G1 (control) than those fed G2 and G3 diets. The differences were significantly ($p<0.05$) with EE digestibility and non significant with CF digestibility. The values of TDN% and DCP% were slightly increased with the control (G1) diet than the other diets. The groups fed G2 had the least values for all digestibility coefficient and feeding values.

The group that receiving the control diet recorded the highest average final live body weight (2084 g) and daily weight gain (20.39g) followed by G3 that receiving sprouted barley as silage and G2 which receiving sprouted barley as fresh. The daily weight gain ranged between 16.27 g. and 20.38 g. / h / d. for all groups without significant differences among them.

Dressing percentage (based on empty weight) showed nearly similar values, being 66.21, 66.22 and 64.19 % for the control group, (G3) and (G2), respectively. With regarded to meat composition of rabbits, the data showed that CP percentage was higher in G2 and G3 than the control, but fat take the reverse trend.

Total feed cost for one kg. growth was 3.402 LE and 3.119 LE for G2 and G3 inverses 3.745 LE for the control. The same trend was noticed with economic efficiency, since, the improvement was 16.12 and 32.09 % for G2 and G3 respectively, compared to the control.

Generally, It is possible to use sprouted barley either in fresh form or as silage instead of CFM up to 30 % without detrimental effects on rabbits growth performance or rabbit's health.

Keywords: rabbits sprouted barley, growth performance, carcass, economic efficiency.

INTRODUCTION

The well-known shortage in animal feedstuffs was behind the great efforts of several researchers for exploitation the agricultural by-product. El-

Shenawy (1990) showed that there are more than 13.75 million tons of agricultural by-products in Egypt annually available can be used in animal feeding. Agriculture Economics (1996) reported that annual quantity of rice straw was 2.5 million-ton (DM). Also, at present, most of these materials are not only a wasting natural resource but also an important source of environmental pollution. The competition between humans and livestock on concentrates is more obvious. Therefore improving the nutritive value of poor quality roughages like natural grasses, straws, stalks and other fibrous agricultural by products might be one solution (EL- Shazley, 1983). On the other hand, rabbits are able to consume forages and agricultural by products containing high levels of fiber (Cheeke, 1986). Also, rabbits have a high prolificacy, growth rat and better meat quality than other farm animals.

This study was conducted to evaluate the effects of partial replacement of concentrate feed mixture by enhanced rice straw with sprouted barley on growth performance, nutrients digestibility, carcass traits and economic efficiency in diets of growing new Zealand white rabbits (NZW)

MATERIALS AND METHODS

The fieldwork of this study was carried out at a private rabbit's farm in Giza, Governorat, during summer 2001, while the chemical analysis was performed at the laboratory of Animal Nutrition Department, Animal Production Research Institute, Dokky, Giza, Egypt.

Preparing materials:

1- Sprouted barley (as fresh): Rice straw was treated physically by mechanically chopping (2-3 cm) and soaking in water for an hour to be used as bedding (soil) material. Also, barley seeds were soaked at the same time in water. Soaking rice straw was placed into perforated trays, each containing half kilogram of soaking rice straw at two layers, between them soaking barley seeds should be sown at rate of 400-g/kg-rice straw. Water was sprayed over it two times every week for two weeks. The final product from each tray was around 2.5 kg.

Worthy description that there have been primary studies on different levels of seeds and the best rate was that one which have been used.

2-Sprouted barley (as silage): Sprouted barley was collected, chopped, mixed with 4 % molasses, ensiled in large plastic bags, pressed well and closed under anaerobic conditions for three months.

The experimental rations were:

Concentrate feed mixture (CFM) 100 % as control(G1)
CFM (70 %) + sprouted barley as fresh (G2)
CFM (70 %) + sprouted barley as silage (G3)

Feeding trials:

Twenty-one New Zealand White rabbits of 7 weeks old and average body weight ranged from 1086 to 1091g were divided into three equal groups according to their average body weight. All rabbits were housed in 3

metabolic cages, they fed three experimental rations. Commercial basal pelleted diet alone (concentrate feed mixture, CFM 100 %) was considered as a control diet to cover the nutrient requirements of growing rabbits according to NRC (1977). The other two groups were fed 70 % of the control diet in addition to free consumption from sprouted barley as fresh or sprouted barley as silage. The concentrate feed mixture (CFM) composition is presented in table (1).

The experimental diets were offered twice daily throughout the experimental period from 7 to 14 weeks of age. Fresh water was available all time by stainless steel nipples in the cages. Daily feed intake of sprouted barley, fresh or silage and CFM were recorded.

Rabbits were weighed and individual live body weights were recorded, weekly, feed conversion as g feed/g gain was calculated.

Table (1): Composition of concentrate feed mixture used in rabbits feeding

Ingredient	%
Wheat bran	40
Soybean meal (44 %)	21
Yellow corn	20
Berseem straw	10
Berseem hay	5
Lime stone	2
Bone meal	1.25
Sodium chloride	0.32
Premix *	0.3
D-L Methionin	0.13

*** each 3 kg contain: vitamin A, 6000000 IU, D3, 600000 IU; E, 40000 mg k3, 200 mg ; B1, 2000 mg; B2, 4000 mg ; B6, 2000 mg, Nicotinic acid, 50000 mg; biotin, 50 mg; folic acid, 3000 mg , Bantothenic acid, 10000 mg; vitamin B12, 10 mg, choline, 250000 mg, Zn, 50000 mg; Mn, 85000 mg; Fe, 50000 mg; Cu, 5000 mg; I, 200 mg; Se, 100 mg, Co, 100 mg.**

Digestibility trials:

At the end of the feeding trial, three digestibility trials were carried out by using three adult males in each trial. All rabbits were individually housed in metabolic cages. Every trial lasted 21 days, 15 days as a preliminary period and 6 days as a collection period. The rabbits were weighed at the start and at the end of the collection period. Samples from sprouted barley, fresh or silage, CFM and faces of each animal were taken daily during the collection period for chemical analysis according to A.O.A.C. (1990).

Slaughter trials:

At 14 weeks of age, three rabbits from each tested group were randomly chosen and slaughtered after fasting for 12 hours. After complete bleeding, they were skinned after feet and tail removing and then eviscerated. Weights of empty carcass with head, liver and heart (dressed weight) were

immediately recorded. Total edible parts weight was calculated as the total weight of carcass with head plus heart and liver. Samples from the eye muscle (*Longissimus dorsi*) area of the carcass were taken for analysis according to A.O.A.C (1990).

Performance index (PI) was calculated according to North (1981) as follows:

PI ={ (Final live body weight, Kg.) / (Feed conversion)} **X** 100

Economic growth efficiency was calculated according to the following equation:

Economic growth efficiency % = (A – B / B) X 100

Where: A = Price of kg gain in Egyptian pound (LE), B = Feed cost per kg gain

(LE)

The feed price (LE / Ton): was 900 LE for concentrate feed mixture, 125 LE for sprouted barley as fresh, and 150 LE for sprouted barley as silage

The price (LE / Kg) of live body weight was 10.00 LE. .

Statistical analysis:

All data were subjected to analysis of variance using the General Linear Model of SAS program (1994). Main effect difference obtained were compared using Duncan's multiple range test (Duncan, 1955) .

RESULTS AND DISCUSSION

Chemical analysis:

The nutritive analyses of feedstuffs on DM basis are presented in Table (2). Data illustrate that sprouted barley either grown on rice straw or insiled lead to great amelioration in crude protein and nitrogen free extract with perceptible reduction in crude fiber percentage. This result agrees with that of Ibrahim *et al.* (2001)

Table (2): Chemical analysis (on DM basis) of feedstuffs which used in the experimental diets

Item	DM	Chemical analysis on DM %					
		OM	CP	EE	CF	Ash	NFE
Rice straw	93.12	81.16	3.31	2.67	40.61	18.84	34.57
Sprouted parley (fresh)	31.19	87.50	8.35	2.87	27.14	12.50	49.14
Sprouted parley (silage)	29.51	85.60	7.66	2.70	33.78	14.40	41.46
Concentrate feed mixture	90.88	90.20	19.38	3.26	12.13	9.80	55.43

Digestibility and feeding value:

Results indicated that digestibility of OM, CP and NFE were highest values with G3 compared with those fed the control (G1) and G2 diets without significant differences (Table 3). While, EE and CF digestibility were the highest values with G1 (control) than those fed G2 and G3 diets. The differences were significantl ($p<0.05$) with EE digestibility and non significant with CF digestibility. The values of TDN% and DCP% were slightly increased

with the control (G1) diet than the other diets. The G2 had were the least values for all digestibility coefficient and feeding values (table 3).

Aguilera (1973) reported that the digestibility of CP was markedly increased and of CF decreased as the dietary forage intake was depressed. The nutritive values of the experimental diets expressed as TDN and DCP showed higher values in the control than G2 and G3 without significant differences among them.

Table (3): Digestibility coefficients and nutritive values % of the experimental diets fed to NZW rabbits (X ± SE)

Item	G1	G2	G3
Digestibility:			
DM	70.29 ±2.76	67.06 ± 2.76	70.26 ± 2.76
OM	70.95 ± 2.71	68.64 ± 2.71	71.45 ± 2.71
CP	77.54 ± 2.00	76.05 ± 2.00	81.69 ± 2.00
EE	92.33 ± 0.80 [a]	83.87 ± 0.80 [b]	85.15 ± 0.80 [b]
CF	25.95 ± 5.92	21.98 ± 5.92	23.07 ± 5.92
NFE	77.25 ± 2.53	76.01 ± 2.53	79.53 ± 2.53
Nutritive Value:			
DCP	13.65 ± 0.50	12.93 ± 0.50	13.39 ± 050
TDN	61.57 ± 2.26	57.96 ± 2.26	58.88 ± 2.26

a – b: means in the same row superscripted with different letters are Significantly (p ≤ 0.05) different.

Live body weight (L.B.W.) and average daily gain (ADG):

The results concerning the influence of different diets on average final live body weight, daily gain, feed intake and feed conversion are shown in Table (4).

Table (4): Growth performance of NZW rabbits fed the experimental diets

Item	G1	G2	G3
No of rabbits	7	7	7
AV. Initial LBW, g.	1086 ± 59.5	1090 ± 59.5	1091 ± 59.5
AV. Final LBW, g.	2084 ± 83.0	1887 ± 83.0	1979 ± 83.0
AV. daily weight gain, g.	20.38	16.27	18.13
Daily feed intake, g/h/day as:			
DM	77.06	58.71	60.0
TDN	47.45	34.03	35.33
DCP	10.52	7.59	8.03
Feed conversion as :			
g. DM /g. gain	3.78	3.61	3.31
Performance index	55.14	52.28	59.78

The average initial live body weight was fairly similar in different experimental diets, it varied between 1086 and 1091 g. The group that receiving the control diet recorded the highest average final live weight (2084 g) followed by G3 which fed the sprouted barley silage(1979 g.) with no significant differences between them. While, the least value was that for

rabbits fed G2. The daily weight gain ranged between 16.27 g. and 20.38 g. / h / d. These results agree with those of Zeid et al (2001) who found that the daily weight gain for rabbits fed different kinds of silages and the control ranged between 14.90 and 20.10 g / h / d. It is also nearly similar with the results obtain by AbdEl-Moneim (1990) who reported a range of 17.32 - 27.39 g. / h/ d. for NZW rabbits under the local conditions. Generally, the differences in daily gain among groups were not significant. Feed intake data (Table 4) showed that their were a decrease in DM, TDN and DCP intake for G2 and G3 compared to the control (G1). Rabbits feed intake depends basically on nutrient contents and palatability of diets (EI – Ayouty et al., 2000). Also, Atyia (1996) indicated the effect of palatability on feed intakes. He found different feed intakes from sugar beet tops silage and berseem silage although both kind of silage contained molasses.

Data in Table (4) revealed that rabbits fed the diets G2 and G3 showed better feed conversion as g DM / g gain (3.61 and 3.31) than the control (3.78) but did not differ significantly. The better feed conversion for G2 and G3 was associated with lower feed intake.

Carcass traits:

Data in Table (5) showed that dressing percentage (based on fasting weight) in tested groups (G2 & G3) tended to be lower (60.15 & 60.68) than the control (62.32) but the differences were not significant. While dressing percentage (based on empty weight) showed nearly similar values between G3 and the control (66.22 and 66.21 %) while, G2 was the lowest value (64.19 %) . This variation also was not significant. These results are nearly similar to those obtained by Succi *et al* (1974) who found that dressing percentage was not affected by feeding rabbits on diets containing silage as compared to the control.

Table (5): Carcass traits of NZW rabbits fed the experimental diets

Item	G1	G2	G3
Fasting weight g.	2063 ± 108.9	1913 ± 108.9	1923 ± 108.9
Empty weight g.	1643 ± 95.57	1538 ± 95.57	1551 ± 95.57
Dressing : Based on fasting weight Based on empty weight	 62.32 66.21 ± 1.24	 60.15 64.19 ± 1.24	 60.68 66.22 ± 1.24
Edible organs % : Heart Liver Kidneys	 0.28 ± 0.007 2.97 ± 0.46 0.63 ± 0.02	 0.24 ± 0.007 3.74 ± 0.46 0.78 ± 0.02	 0.29 ± 0.007 4.52 ± 0.46 0.72 ± 0.02
Physical character: Eye muscle area (cm^2) Water holding capacity	 9.66 ± 0.79 13.50 ± 1.81	 8.16 ± 0.79 15.33 ± 1.81	 9.00 ± 0.79 11.00 ± 1.81
Chemical composition on DM basis DM CP EE Ash	 30.34 77.73 19.33 2.94	 28.58 83.98 12.58 3.03	 27.26 82.74 13.84 3.41

The percentage values of different organs (heart, liver and kidney) are presented in Table (5). The heart percentage value was higher in treatment (G3) but without significance among treatments. Also, the liver percentages in groups (G2) and (G3) were higher compared with the control. The kidneys took the same trend and also, the differences were not significant.

Chemical composition of meat:

With regard to meat composition of rabbits, the data showed that CP percentage was higher in G2 and G3 than in the control (Table 5) whereas the fat took the reverse trend. These results agree with those of Gad – Allah (1997) who concluded that feeding NZW rabbits on different kinds of silage led to desirable effect on compositions of meat by increasing protein percentage and decreasing fat content. Also, EL – Ayouty et al (2000) found the same trend in CP and EE in meat of rabbits fed on berseem silage, silage mixture (1:1) of sugar beet tops and berseem and maize silage. While Atiya (1996) found that feeding NZW rabbits on diets containing silage did not affect meat composition.

The eye muscle (*Longissimus dorsi*) area is a good criterion for boneless meat in the carcass. The results showed that the treatments did not affect eye muscle area. The same trend was noticed with water holding capacity.

Feed cost and economic efficiency:

Data concerning feed cost and economic efficiency are presented in Table (6). In comparing total feed cost per one kg. growth of the tested groups with the control, there was decrease in the values (3.402 and 3.119) for G2 and G3 inverses 3.745 LE for control. The same trend was noticed with economic efficiency, so, the improvement was 16.12 and 32.09 %(G2 and G3, respectively) compared to the control. Generally the improvement in feed efficiency may be attributed to an increase in efficiency of nutrient absorption and nutrient utilization (Fairly et al, 1985).

Table (6): Economic efficiency of NZW rabbits as affected by the experimental diets.

Item	G1	G2	G3
Total body weight gain, g	998.5	797.1	887.7
Price / kg. body weight LE	10.00	10.00	10.00
Total revenue / rabbit LE	9.985	7.971	8.877
Total feed intake / rabbit, g: CFM Sprouted parley (fresh) Sprouted parley (silage)	 4155 ---- ----	 2910 743 ----	 2910 ---- 999
Total feed cost / rabbit LE	3.740	2.712	2.769
Total feed cost / 1kg growth	3.745	3.402	3.119
Net revenue LE	6.245	5.259	6.108
Economic efficiency	167.02	193.94	220.62

From the nutritional and economical point of view, it could be concluded that partial replacement of concentrate feed mixture by sprouted

barley on rice straw, as fresh or silage up to 30% is possible without any adversable effects on performance and health of rabbits.

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تقييم استخدام الشعير المنبت فى تغذية الأرانب

فتحية عبد العظيم إبراهيم - عبد المنعم محمد مصطفى زيد.
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تهدف هذه الدراسة إلى تقييم تأثير الاستبدال الجزئي للعلف المركز بالشعير المنبت على فرشة من قش الأرز، واستخدام المنتج بشكله الطازج أو بعد تحويلة إلى سيلاج، وذلك فى تغذية الأرانب النيوزلندي لدراسة قياسات النمو والقيم الهضمية ومواصفات الذبيحة والكفاءة الاقتصادية.

تم تقسيم ٢١ ذكر أرنب نيوزلندي أبيض عمر سبعة أسابيع بمتوسط وزن يتراوح بين١٠٨٦ إلى ١٠٩١ جم إلى ثلاث مجموعات (٧ فى كل مجموعة) أعطيت ثلاث علائق هي العلف المركز بنسبة ١٠٠ % لمجموعة للكنترول ثم ٧٠ % فقط من لعلف المركز لكل من المجموعتين الأخريين ومضاف إلية الشعير المنبت الطازج كاستهلاك حر للمجموعة الثانية أو سيلاج الشعير المنبت كاستهلاك حر أيضا للمجموعة الثالثة, واستمرت هذه التغذية لمدة سبعة أسابيع وتم دراسة آثارها على معاملات الهضم والقيم الغذائية ومقاييس النمو ومواصفات الذبيحة و كذلك الكفاءة الاقتصادية.

أوضحت النتائج أن معامل هضم الدهون فى المعاملات الثانية والثالثة كانت أقل - معنويا - عن مجموعة المقارنة, أما قيم معاملات هضم المادة الجافة والمادة العضوية وكذلك البروتين الخام فكان يميل إلى الانخفاض في المعاملة الثانية (المغذاة على الشعير المنبت الطازج) عن مجموعة المقارنة والمجموعة الثالثة, كما أن معامل هضم الألياف كان مرتفعا في مجموعة المقارنة ولكن ليس بشكل معنوي.

أعطت مجموعة المقارنة أعلى وزن حي في نهاية التجربة (٢٠٨٤جم) تليها المجموعة الثالثة (١٩٧٩ جم) ثم المجموعة الثانية (١٨٨٧ جم)، وتراوح النمو اليومي بين ١٦,٢٧ و ٢٠,٣٨ جم لكل المجموعات.

أظهرت نسبة التصافي (المنسوبة للذبيحة الفارغة) قيم متقاربة حيث كانت ٦٦,٢١ % لمجموعة المقارنة ثم ٦٦,٢٢ % للمجموعة الثالثة و ٦٤,١٩ % للمجموعة الثانية. وبالنسبة للتركيب الكيماوي للحم فقد تبين زيادة نسبة البروتين مع انخفاض نسبة الدهن في المجموعتين الثانية والثالثة مقارنة بمجموعة المقارنة.

كانت تكلفة التغذية لكل كيلو جرام لحم حي هي ٣,٤٠٢ جنيها للمجموعة الثانية، ٣,١١٩ جنيها للمجموعة الثالثة مقابل ٣,٧٤٥ جنيها لمجموعة المقارنة. والكفاءة الاقتصادية كان لها نفس الاتجاه حيث تحسنت في المجموعة الثانية والثالثة بمعدل ١٦,١٢% , ٣٢,٠٩% مقارنة بمجموعة المقارنة.

وعموما يمكن القول انه يمكن استخدام الشعير المنبت بشكل طازج او في صورة سيلاج كبديل للعلف المركز حتى نسبة ٣٠% دون أي تأثير ضار على مقاييس النمو أو الصحة في الأرانب النامية.