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USING BY-PRODUCTS FOR FEEDING GROWING RABBITS UNDER EGYPTIAN CONDITIONS.

Ayyat M.S.; G.A. Abdel-Rahman; U.M. Abdel –Monem and I.M. Abdel-Hady

Department of Animal Production, Faculty of Agriculture, Zagazig University, Egypt.

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ABSTRACT: Eighty eight male New Zealand White rabbits, 28 day old, with nearly equal live body weight at the beginning of the experiment were randomly allotted to eleven treatment groups, of 8 rabbits each. The first rabbit group was fed on a control (commercial) diet (Diet 1), while the second group was fed on the same diet substituted of feedstuff ingredients with 20% rice bran (rice polish; Diet 2), the third group was fed on the control diet substituted with 10% rice polish (Diet 3), the fourth group (Diet 4) was fed on the control diet substituted with 20% rice hulls, the fifth group (Diet 5) was fed on the control diet substituted with 10% rice hulls, the sixth group (Diet 6) was fed on the control diet substituted with 23% brewer's grain, the seventh group (Diet 7) was fed on the control diet substituted with 13% brewer's grain, the eighth group (Diet 8) was fed on the control diet substituted with 15% black cumin *(Nigells sativa)* meal, the ninth group (Diet 9) was fed on the control diet substituted with 10% black cumin meal, the tenth group (Diet 10) was fed on the control diet substituted with 25% mushroom by-product and the eleventh group (Diet 11) was fed on the control diet substituted with 15% mushroom by-product. Effects of by-products substituted in rabbit diets insignificantly affected live body weight and daily gain. Substituted rabbit diet with 15% black cumin meal recorded higher growth rate than the other by-products substituted, then rabbits fed diet substituted with rice bran. Rabbits fed diet containing agricultural by-products slightly increased daily

feed intake than those fed control diet. Feed conversion ratio impaired with substituted ordinary feedstuffs with agricultural by-products. Rabbits fed diets containing mushroom by-product (25%), rice bran (10%) or brewer's grain (23%) recorded the very bad feed conversion ratio than the other experimental groups. Rabbits fed diets containing black cumin meal, mushroom by-product and rice by-products recorded lower feed cost. Rabbits fed control diet or diet containing 15% black cumin meal recorded the higher final margin than the other experimental groups. However, rabbits fed diet containing 25% mushroom by-product recorded the lower margin. Serum total protein, albumin, urea-N, creatinine, and transaminase enzymes (AST and ALT) concentrations insignificantly affected with substituted traditional feedstuffs by agricultural by-products. The normal concentrations of blood parameters indicated no disturbance of animal health was clinically detected. Analysis of variance indicated that the diet type affected significantly (P<0.01) pre-slaughter body weight. Analysis of covariance cleared that the diet type insignificantly affected carcass and non-carcass weights.

Key words: Agriculture by - Products, Growth performance, Carcass component, Serum metabolites, Rabbits.

INTRODUCTION

The lack of sufficient feeds to meet the nutritional requirements of existing animal population is one of the most critical problems of animal production in Egypt. The big gab between the requirements and the available sources necessitates great efforts to realize the best use of the available feed resources. In recent years there has been increased awareness of the advantages of rabbit meat production in developing countries as a means to alleviate world food shortages (Lukefahr and Cheeke 1990a and b; 1991a and b). This is largely attributable to the rabbit's high rate of reproduction. Other advantages are early maturity, rapid growth rate, high genetic selection potential, efficient feed and landscape utilization, and limited competition with humans for similar foods and high quality nutritious meat (Cheeke 1980). Rabbit are non-ruminant herbivores, with an enlarged hindgut. Fermentation occurs primarily in the caecum and coprophagy is routinely practiced. The colon functions in the separation of particles according to size. Large, less dense fibre particles are moved rapidly through the colon by peristalsis, while fluids and small particles are moved by reverse peristalsis, accomplished by contractions of the haustra, into the caecum (Cheeke 1986). The products of cecal fermentation are either absorbed or consumed by coprophagy (Cheeke 1986). Rabbits can be successfully raised on diets consisting entirely of forages and cereal by-products. Rabbits can be raised with a high level of production on a diet with the protein and energy provided entirely by forage (alfalfa meal) and cereal by-products (wheat mill run) (Raharjo *et al*., 1986a and b). The major source of income in commercial rabbit production is the sale of animals for meat, as laboratory animals and breeding stock and perhaps pet stock. Other sources of income might include the sale of manure, earthworms and pelts.

The increasing costs of manufactured feeds and the declining land area available for grazing and/or pasture production due to human population pressure have led to a growing interest in the utilization of crop by-products to feed livestock. Although crop by-products are available in large quantities, they do not in all cases occur at user sites (Mlay, 1987).

Some authors showed also that in rabbit feeding it is important not only the chemical quality but also the physical quality (particularly the size of the fibre particles), to reduce the incidence of enteritis (Gidenne, 1992; Lambertini *et al*. 1996).

The inclusion of alternative sources of fibre in rabbit diets can influence significantly rate of passage, caecal fermentation and soft faeces excretion (Fraga *et al*., 1991; Garcea *et al*., 1999; Garcea *et al*., ~~2000 b~~). One of the advantages of rabbit production in tropical countries is that rabbits can be fed forages and agricultural by-products that are not suitable for human consumption (Lukefahr and Cheeke, 1990a).

With an increase in crop yields and cropping intensity, the management of rice by-products is becoming a problem as well as an opportunity. There are many good reasons for using rice by-products, they contain energy, they are a renewable resource, and their utilization can reduce waste problems and related environmental pollution (Raharjo *et al.*, 1986a, 1988).

The chemical composition of *Nigells sativa* seeds were 21.0% protein, 35% fat and 5.5% nitrogen free extract (Babayan *et al.*, 1978). Abdel-Aal and Attia (1993) found that *Nigells sativa* have 38.7% crude fat, 21% crude protein, 13.9% crude fibre, 14.9% starch, 6.0% soluble sugars and 4.9% ash, and it was considered a good source of protein, phosphorus, calcium, potassium, magnisum and sodium. Sener *et al.* (1985) found that *Nigells sativa* seeds contained 26.6% oil of which the major fatty acids were linoleic (64.0%) and palmitic (20.4%) acids. *Nigells sativa* seeds have 35.0% oil which contained about 1.5% essential fatty acids of very strong antimicrobial properties (Rathee *et al.*, 1982 and Hedaya, 1995).

Nasr *et al.* (1996) found that rabbits fed the diet substituted with 10% *Nigells sativa* or 5% soybean meal recorded higher values than in the control group (fed commercial diet). Rabbits fed diets substituted 10% *Nigells sativa* or soybean meal showed higher values of fat and energy in the meat than the control group.

The straw commonly used as a substrate for cultivation of edible mushroom is a by-product (Compost) that seems worthwhile to be studied as feed for animals. *Pleurotus ostreatus* is able to utilize several substrates rich in cellulose and lignine like straw, hay leaves and saw dust and it is able to fixed and metabolize the atmospheric nitrogen. A useful ballast effect together with a better digestibility of fibre could then be assumed when Compost is supplied to rabbit. Palatability of Compost was slightly better than straw but not as good as hay. No disturbance of animal health was clinically or histologically detected (Valentini *et al.*, 1984).

The experimental objective was to evaluate some agricultural by-products as partial replacements for a commercial pelleted diet for growing rabbits.

MATERIALS AND METHODS

One hundred and ten male New Zealand White rabbits, 28 day old, with nearly equal live body weight (579.46 g) at the beginning of the experiment were randomly allotted to eleven treatment groups, of 8 rabbits each. The first rabbit group was fed on a control (commercial) diet (Diet 1), while the second group was fed on the same diet substituted of feedstuff ingredients with 20% rice bran (rice polish; Diet 2), the third group was fed on the control diet substituted with 10% rice bran (Diet 3), the fourth group (Diet 4) was fed on the control diets substituted with 20% rice germ, the fifth group (Diet 5) was fed on the control diet substituted with 10% rice germ, the sixth group (Diet 6) was fed on the control diet substituted with 23% brewer's grain, the seventh group (Diet 7) was fed on the control diet substituted with 13% brewer's grain, the eighth group (Diet 8) was fed on the control diet substituted with 15% black cumin (*Nigells sativa*) meal, the ninth group (Diet 9) was fed on the control diet substituted with 10% black cumin meal, the tenth group (Diet 10) was fed on the control diet substituted with 25% mushroom by-product and the eleventh group (Diet 11) was fed on the control diet substituted with 15% mushroom by-product (Table 1). The rabbits were fed on pelleted diet *ad libitum.*

Rabbits in all groups were kept under the same managerial and hygienic conditions. The rabbits were housed in batteries provided with feeders and automatic drinkers. The batteries were located in a conventional confined and windowed building not heated and naturally ventilated, side electric fans were used. Economic evaluation was calculated as the following equation (According to Ayyat, 1991), Margin = Return from body gain weight - Feed cost. Other overhead costs were assumed constant. The price of one kg of diets were shown in Table 1, and price of selling of one kg live body weight of rabbits was 10.0 LE (Egyptian pound = 0.23 US$). At the end of experimental period three rabbits from each group were randomly selected to collecting the blood samples. The blood samples were centrifuged at 3000 RBM for 20 minutes to separate the serum. The collected serum were stored at -20 °C until assay. Total protein, albumin, urea-N, creatinine and serum transaminase enzymes (AST and ALT) were estimated in blood serum by colormetric methods using commercial kits. At the end of the experimental period three rabbits from each group were randomly taken for slaughter after being fasted for 12 hours. After complete bleeding, the carcass and some non-carcass components were weighed. The carcass was separated into three cuts (fore-limbs, trunk and hind-limbs). Each of the three cuts was weighed.

The data of live body weight and gain and blood components were statistically analyzed by one way experiment (Snedecor and Cochran, 1994) according the following model: $Y_{ij} = \mu + D_i + E_{ij}$,where μ = The overall mean, D_i = The fixed effect of i^{th} diet type (D_i = 1 ... 11), E_{ij} = Random error.

Slaughter data were analyzed by analysis of covariance according the following model: $Y_{ij} = \mu + D_i + b(X\text{-}x) + E_{ij}$,where μ, P_i, C_j, DC_{ij} and E_{ijkl} were as defined in the previous model, b = Regression coefficient of Y on X (slaughter weight) and x is the arithmetic means of x's (slaughter weight). The deference between experimental groups was separated by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth performance :

Live body weight and daily body gain :

Effects of by-products substituted in rabbit diets insignificantly affected live body weight and daily gain weight (Table 2). Substituted rabbit diet with 15% black cumin meal recorded higher live body weight than the other by-products, then followed by 13% brewer's grain and substituted with 20% rice bran. Increasing live body weight in rabbits fed diets contained black cumin meal may be attributed to the high level of fat and the high energy level in the rabbit diets. Babayan *et al.* (1978) and Abdel-Aal and Attia (1993) reported that *Nigells sativa* seeds contain high level of fat (about 35-38%) and protein (about 13-21%). Also, Sener *et al.* (1985) found that *Nigells sativa* seeds contained 26.6% oil of which the major fatty acids were linoleic (64.0%) and palmitic (20.4%) acids.

Bhatt (2000) revealed the optimum protein to energy ratio with diets containing rice polish; secondly the importance of rice polish as source of energy for rabbits. Thus it could be concluded that rice polish can replace dietary maize supplement up to 50 % or could be used up to 15% in the feeding regime of rabbits. Also, Nasr *et al.* (1996) found that live weight and daily gain at 12 weeks of age were significantly ($P<0.05$) higher for rabbit groups fed diets substituted with 10 and 5% soybean meal than in the groups fed diet substituted with 5 or 10% *Nigells sativa* or commercial diet. Raharjo (1987) reported that rice bran is an excellent energy source for rabbits, and is available in large quantities in many developing countries.

Rice polish is the finely powdered material obtained during polishing of rice kernels, after the hulls and bran have been removed; its protein and fat contents are equivalent to that of rice bran and total digestible nutrients are equivalent to maize (Morrison, 1961). Soluble carbohydrate contents of rice by products are lower than maize (McDonald *et al.*, 1995) which reflected its suitability as a rabbit feed ingredient because higher soluble carbohydrates in diet aggravate enteric disorders (Robinson *et al.*, 1988).

Daily feed intake, feed conversion and feed cost:

Rabbits fed diet containing agricultural by-products slightly increased daily feed intake than those fed commercial diet (control diet), while feed conversion ratio impaired (Table 3). Increasing in feed intake may be attributed to the high level of fibre in the agricultural by-products. The inclusion of alternative sources of fibre in rabbit diets can influence significantly rate of passage, caecal fermentation and soft faeces excretion (Fraga *et al.*, 1991; Garcea *et al.*, 1999; Garcea *et al.*, 2000 a and b). The straw commonly used as a substrate for cultivation of edible mushroom is a by-product that seems worthwhile to be studied as feed for animals. Mushroom by-product contained high level of fibre (Valentini *et al.*, 1984). The increasing of fibre level in mushroom by-product may be related to decrease the feed conversion ratio.

Rabbits fed diets containing mushroom by-product (25%), rice gran (10%) or brewer's grain (23%) recorded the very bad feed conversion ratio than the other experimental groups. The best feed conversion ratio was obtained in rabbit group fed diet containing black cumin meal. Agricultural by-products can supply a major part of the protein and fiber needs of rabbits.

Rabbit will eat virtually anything that grows in the soil. Agricultural by-products are useful feeds and suitable for rabbit feeding. According to Cheeke (1987) the agricultural by-products can be used in rabbit feeding. This can be practical under conditions of small-scale backyard rabbit production, particularly in tropical countries where leafy trees are abundant and labour is readily available. However, the technology has not progressed much, mainly through lack of appropriate feeding systems.

Rabbits fed diets containing black cumin meal, mushroom by-product and rice by-products recorded lower feed cost. On the other hand, rabbits fed diets containing 13% brewer's grain recorded the higher feed cost. Rabbits fed control diet or diet containing 15% black cumin meal recorded the higher return from body gain weight than the other experimental groups. However, rabbits fed diet containing 25% mushroom by-product recorded the lower return from body gain. Rabbits fed control diet or diet containing 15% black cumin meal recorded the higher final margin than the other experimental groups. However, rabbits fed diet containing 25% mushroom by-product recorded the lower margin (Table 3). From the economical point of view, rabbits fed the diet substituted with 10% *Nigells sativa* or 5% soybean meal recorded higher values than in the control group (Nasr *et al.*, 1996). El-Shurafa and Fagih (1982) reported that the cost of producing one kilogram of body gain weight was higher with 35% in animal fed conventional diet than those fed diet containing 25% olive pulp.

Serum metabolites:

Serum total protein, albumin, urea-N, creatinine and AST and ALT insignificantly affected with substituted traditional feedstuffs by agricultural by-products (Table 4). Serum urea-N and creatinine slightly changed in rabbit groups fed diets containing the agricultural by-products. The obtained results of blood urea-N and creatinine indicated no disturbance of animal health was clinically detected. The obtained results of serum transaminase enzymes indicated no disturbance of animal health was clinically detected. *Nigells sativa* (black cumin) seeds contained about essential fatty acids of very strong antimicrobial properties (Rathee *et al.*, 1982 and Hedaya, 1995).

Carcass traits:

Analysis of variance indicated that the diet type affected significantly (P<0.01) pre-slaughter body weight (Table 5 and 6). Analysis of covariance cleared that the liner regression on pre-slaughter live body weight were significantly affected carcass weight, liver weight, kidney fat weight and carcass cuts. ~~Analysis of covariance~~ cleared that the diet type insignificantly affected carcass and non-carcass weights. Carcass parameters as dressed carcass, liver weight and dressing percentage remained unaffected due to presence of rice polish in the diet (Bhatt, 2000).

Thus, agricultural by-products can be used as a component of the concentrate feeds of rabbits to partially replace expensive feedstuffs in the diets (Bamikol *et al.*, 2000a).

In conclusion, the previous by- products rice bran, rice germ, brewer's grain, nigella sativa and mushroom by-product can be used successively and safety in feeding New Zealand white rabbits without adversely effects on their performance.

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Table 1. Composition and chemical analysis of the experimental diets.

Items	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
Ingredients (%):											
Alfalfa hay	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	25.0	25.0
Soybean meal	13.0	13.0	13.0	9.0	11.0	10.0	11.0	8.0	10.0	13.0	14.0
Yellow corn	24.0	14.0	19.0	17.0	20.0	14.0	18.0	21.0	24.0	20.0	25.0
Wheat bran	28.0	18.0	23.0	19.0	24.0	18.0	23.0	21.0	21.0	12.0	16.0
Rice polish	-	20.0	10.0	-	-	-	-	-	-	-	-
Rice hulls	-	-	-	20.0	10.0	-	-	-	-	-	-
Brewer's grain	-	-	-	-	-	23.0	13.0	-	-	-	-
Black cumin meal	-	-	-	-	-	-	-	15.0	10.0	-	-
Mushroom by-product	-	-	-	-	-	-	-	-	-	25.0	15.0
Molasses	0.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Limestone	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Sodium chloride salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Vit. and min. premix	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Chemical composition[1]:											
CP %	16.06	16.36	16.24	16.38	16.26	16.52	16.33	15.95	15.95	15.76	16.03
CF %	13.30	14.49	13.89	13.40	13.39	15.64	14.62	14.47	13.93	17.78	14.89
DE (kcal/kg)	2664.50	2618.70	2641.20	2639.00	2646.0	2647.0	2657.20	2728.40	2735.10	2535.0	2610.30
Price (LE/Ton)	750.60	716.60	733.60	693.80	721.20	689.0	713.2	727.10	741.0	654.10	709.30

Analyzed according to A.O.A.C. (1990)

Table 2. Live body weight (g) and daily gain weight (g/day) of rabbits at different experimental periods as affected by diet type.

Items	W0	W4	W8	G 0-8
D1	584.38±13.48	1316.50±58.85	1797.50±66.94	21.66±1.13
D2	580.63±25.57	1181.25±41.02	1738.75±57.05	20.68±0.73
D3	572.86±25.04	1172.86±45.37	1602.14±28.62	18.38±0.77
D4	580.00±18.22	1211.88±51.78	1657.50±23.07	19.24±0.47
D5	574.38±17.10	1176.88±54.49	1672.50±37.77	19.61±0.63
D6	581.25±20.83	1255.63±34.90	1677.50±56.83	19.58±0.81
D7	596.88±27.24	1221.88±26.30	1745.63±30.10	20.51±0.54
D8	580.00±19.18	1296.25±79.77	1788.75±64.07	21.59±0.93
D9	576.88±20.33	1191.88±86.65	1691.25±83.78	19.90±1.23
D10	564.29±10.88	1077.14±15.11	1560.00±30.92	17.78±0.51
D11	582.50±20.42	1258.75±74.18	1703.13±68.05	20.01±1.03
Significance	NS	NS	NS	NS

NS = Not significant.

D1 = control diet (commercial diet), D2 = diet substituted with 20% rice bran (rice polish), D3 = diet substituted with 10% rice polish, D4 = diet substituted with 20% rice hulls, D5 = diet substituted with 10% rice hulls, D6 = diet substituted with 23% brewer's grain, D7 = diet substituted with 13% brewer's grain, D8 = diet substituted with 15% black cumin meal, D9 = diet substituted with 10% black cumin meal, D10 = diet substituted with 25% mushroom by-product and D11 = diet substituted with 15% mushroom by-product.

Table 3. Daily feed intake (g/day), feed conversion (g feed/g gain), feed cost, return from body gain and final margin (LE/rabbit) of rabbits at different experimental periods as affected by season and some feed additives and their interaction.

Items	Daily feed intake	Feed conversion	Feed cost	Return from body gain	Final margin
D1	102.63	4.738	4.341	12.13	7.816
D2	114.33	5.529	4.588	11.58	6.992
D3	108.43	5.899	4.454	10.29	5.836
D4	110.10	5.722	4.278	10.77	6.492
D5	107.10	5.461	4.326	10.98	6.654
D6	113.46	5.795	4.378	10.96	6.582
D7	107.58	5.245	4.724	11.49	6.766
D8	106.45	4.850	7.334	12.09	7.756
D9	104.51	5.252	7.337	11.14	6.803
D10	116.35	6.544	4.262	9.96	5.698
D11	111.63	5.579	4.434	11.21	6.776

Table 4. Serum total protein, albumin, urea-N, creatinine, AST and ALT of rabbits as affected by diet type.

Items	Total protein (g/dl)	Albumin (g/dl)	Urea-N (mg/dl)	Creatinine (mg/dl)	AST (U/l)	ALT (U/l)
D1	6.59±0.12	3.67±0.14	13.17±0.62	1.006±0.012	30.03±0.18	13.27±0.55
D2	6.29±0.20	3.47±0.03	14.17±1.11	0.967±0.029	31.30±0.29	14.17±0.12
D3	6.37±0.11	3.45±0.23	13.50±0.80	0.957±0.041	31.33±0.32	12.77±0.52
D4	6.42±0.18	3.63±0.07	13.37±0.82	1.010±0.021	30.67±0.34	13.20±0.65
D5	6.18±0.11	3.57±0.12	13.23±1.30	0.973±0.042	30.60±0.66	12.00±0.52
D6	6.38±0.19	3.65±0.18	12.70±0.50	0.967±0.045	30.63±0.77	12.17±0.13
D7	6.26±0.12	3.62±0.03	12.03±0.61	0.980±0.029	31.17±0.71	12.97±0.07
D8	6.35±0.21	3.62±0.13	12.50±0.50	0.967±0.044	30.90±0.12	12.23±0.37
D9	6.48±0.06	3.67±0.03	11.73±0.23	0.963±0.033	30.23±0.43	12.37±0.54
D10	6.47±0.19	3.69±0.16	12.13±0.47	0.940±0.045	30.23±0.26	12.53±0.54
D11	6.35±0.18	3.66±0.15	11.93±0.15	0.963±0.035	30.07±0.50	12.27±0.60
Signif.	NS.	NS	NS	NS	NS	NS

NS = Not significant.

Table 5. Actual pre-slaughter live body weight and adjusted carcass and non-carcass components weight (g) of rabbits as affected by diet type.

Items	Slaughter live Weight	Carcass weight	Liver weight	Kidney weight	Kidney fat weight
D1	1778.33±29.49	1113.65±19.54	61.43±5.06	11.79±1.25	17.88±1.02
D2	1840.00±35.47	1128.60±17.72	69.81±4.59	14.00±1.13	16.72±0.92
D3	1794.67±16.02	1106.72±18.99	67.89±1.92	13.33±1.21	17.09±0.99
D4	1966.67±47.99	1131.35±16.83	61.38±4.36	13.40±1.08	17.04±0.88
D5	2120.00±20.21	1198.86±20.99	59.20±5.44	13.60±1.34	16.14±1.10
D6	1985.00±45.83	1117.99±17.05	67.07±4.42	14.93±1.09	16.23±0.89
D7	2003.33±43.43	1120.64±17.36	61.09±4.50	11.79±1.11	18.41±0.91
D8	2070.00±15.28	1110.53±19.13	55.87±4.96	14.63±1.22	17.21±1.00
D9	1870.00±100.37	1124.20±17.13	62.54±4.44	15.44±1.10	17.82±0.89
D10	1958.33±58.62	1137.91±16.76	68.49±4.34	15.46±1.07	17.44±0.87
D11	1845.00±87.89	1110.53±17.61	66.54±4.56	14.63±1.13	17.02±0.92
Sign.	**	NS	NS	NS	NS

NS = Not significant and ** P<0.01.

Linear regression on live pre-slaughter body weight was significantly (P<0.05, 0.01 or 0.001) for carcass, liver and kidney fat weights.

Table 6. Adjusted carcass cuts weight (g) of rabbits as affected by season and some feed additives and their interaction

Items	Head weight	Fore part weight	Intermediate part weight	Hind part weight	Prime cuts weight
D1	124.17±6.34	248.08±7.56	288.64±14.29	355.55±18.92	644.19±15.40
D2	123.41±5.75	256.72±6.86	291.38±12.96	352.93±17.16	644.31±13.97
D3	124.31±6.16	245.95±7.35	277.94±13.89	353.42±18.38	631.36±14.96
D4	113.25±5.46	250.25±6.51	293.04±12.31	380.79±16.29	673.84±13.27
D5	113.94±6.82	264.64±8.13	322.18±15.36	410.13±20.33	732.31±16.55
D6	118.21±5.54	251.20±6.60	305.39±12.47	344.52±16.51	649.91±13.44
D7	116.50±5.64	243.81±6.72	286.07±12.70	381.58±16.81	667.65±13.69
D8	110.27±6.21	241.81±7.40	274.75±13.99	396.94±18.52	671.69±15.08
D9	130.95±5.56	239.82±6.63	382.04±12.53	272.51±16.59	645.55±13.51
D10	116.37±5.44	256.33±6.49	347.58±12.26	313.04±16.22	660.62±13.21
D11	127.28±5.72	244.07±0.82	355.99±12.88	282.92±17.05	638.91±13.88

NS = Not significant.

Linear regression on live pre-slaughter body weight was significantly (P<0.01 or 0.001) for head, fore part, hind part and prime cuts weights.

استخدام مخلفات الحقل فى تغذية الأرانب، تحت الظروف المصرية.

محمد صلاح عياط، جمال الدين على عبد الرحمن، اسامة محمد عبد المنعم،
اسماعيل محمد عبد الهادى
قسم الإنتاج الحيوانى – كلية الزراعة – جامعة الزقازيق، الزقازيق، مصر.

وقد استخدم فى هذه الدراسة ٨٨ ذكر أرنب نيوزيلاندى أبيض عمر ٢٨ يوم وكانت متقاربة فى الوزن الحى بمتوسط ٥٧٩,٤٦ جم فى بداية التجربة. بغرض استبدال مكونات العليقة العادية بمخلفات الحقل. قسمت الأرانب إلى ١١ مجموعة فى كل مجموعة ٨ حيوانات وتم تغذية حيوانات المجموعة الأولى على عليقة مقارنة (ع ١)، المجموعة الثانية على عليقة تحتوى على ٢٠% رجيع الكون (ع ٢)، والمجموعة الثالثة على عليقة تحتوى على ١٠% رجيع كون (ع ٣)، والمجموعة الرابعة على عليقة تحتوى على ٢٠% جرمة الأرز (ع ٤)، والجموعة الخامسة على عليقة بها ١٠% جرمة أرز (ع ٥)، والمجموعة السادسة على عليقة بها ٢٣% مخلفات الشعير من تصنيع البيرة (ع ٦)، والمجموعة السابعة بها ١٣% مخلفات صناعة البيرة (ع ٧)، المجموعة الثامنة على ١٥% من كسب حبة البركة (ع ٨)، والمجموعة التاسعة على ١٠% كسب حبة البركة (ع ٩)، والمجموعة العاشرة على ٢٥% مخلفات عيش الغراب (ع ١٠)، والمجموعة الحادية عشر على ١٥% مخلفات عيش الغراب (ع ١١). وقد أظهرت النتائج أن إضافة مخلفات الحقل لم تأثر معنويا فى الوزن الحى وكذلك معدل النمو. إضافة ١٥% كسب حبة البركة حقق أعلى معدل نمو عن باقى المجاميع ويلى ذلك تلك التى غذيت على عليقة بها رجيع الكون. معدل تناول الغذاء يزداد قليلا فى حين معدل التحويل الغذائى ينخفض قليلا فى الأرنب التى تتغذى على المخلفات. الأرانب التى تتغذى على ٢٥% مخلفات عيش الغراب و١٠% رجيع كون و ٢٣% مخلفات البيرة سجلت أقل معدل للتحويل الغذائى فى حين أفضل معدل تحويل غذائى فى تلك المغذاة على كسب حبة البركة. الأرانب التى تتغذى على غذاء يحتوى على كسب حبة البركة أو مخلفات عيش الغراب أو مخلفات الأرز سجلت أقلة تكلفة للغذاء. الأرانب التى تتغذى على العليقة المقارنة أو تلك التى تحتوى على ١٥% كسب حبة البركة سجلت أعلى هامش ربح، وتلك التى غذيت على غذاء يحتوى على ٢٥% مخلفات عيش الغراب سجلت أقل هامش ربح. مكونات الدم لم تتأثر معنويا بإحلال المخلفات فى غذاء الأرانب مما يؤكد عدم تعرض الأرانب لأى مشاكل صحية. مكونات الدبيحة لم تتأثر معنويا باستخدام المخلفات ولكن تأثرت بالوزن الحى قبل الذبح.