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EVALUATION OF BIOLOGICALLY TREATED RICE STRAW IN BROILER FEED

By

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Abstract: *The experiment was designed to evaluate the effect of feeding agriculture by-product as biologically treated rice straw, wheat bran at different levels on the performance of broiler chicks. A total number of five hundred and ten, unsexed one day old, Cobb 500 broiler chicks, were equally distributed into seventeen experimental groups, three replicates of ten chicks each on the basis of fiber sources and levels. Broilers were fed isonitrogenous and isocaloric diets containing two dietary fiber sources, (wheat bran and rice straw treated by bio-chemical-thermo-mechanical method to ferment the organic material in order to improve the nutritional value) at different up-graded levels 0, 5%, 10%, 15%, 20%, 25%, 30%, 35%, and 40%. The experimental period lasted for 7 weeks. Excreta were collected during the 6th week of age to determine the nutrients digestibility. The following results were obtained:*

- 1. The treatment of rice straw increased the metabolizable energy and protein content with sharp reduction in fiber and silica percentage.*
- 2. The Maximum live body weight (LBW) and body weight gain (BWG) of broilers fed diet contained 20% B.T.rice straw were insignificantly higher than those fed 25% B.T.rice straw. The lowest LBW and BWG were recorded with those fed diets contained 40% wheat bran. Feeding broilers on diets contained 20% B.T.rice straw was significantly ($P<0.05$) improved in feed efficiency compared to the other treatments except with those fed 15% or 25% B.T.rice straw. The highest dressing percentage was recorded with chicks fed 5% wheat bran. While broilers fed diets contained 40% wheat bran had significantly ($P<0.05$) lower dressing percentage, than other treatments. Abdominal fat was increased when broilers fed diets contained B.T.rice straw especially at 20%, less values were recorded for broilers fed the control diet.*
- 3. The digestibility of most nutrients and TDN were significantly ($P<0.05$) higher with broilers fed diets contained 5% B.T.rice straw compared to those fed up to 25% experimental fiber sources. There were no significant different among broilers fed diets contained 5%, 10%, 15%, 20% B.T.rice straw, 10% wheat bran and those fed the control diet. Metabolizable energy of broilers fed diets contained 5% B.T.rice straw recorded the highest value, while the lowest value observed with those fed 40% wheat bran.*
- 4. The lowest heat increment was recorded for broilers fed 5% B.T.rice straw, while the highest value was observed with those fed diets contained 40% wheat bran. The passage time after feeding of broilers depends on the age and water contents of which they are fed. Broilers fed diets contained B.T.rice straw was significantly ($P<0.05$) improved in the rate of pass than those fed with wheat bran, and insignificantly with broilers fed the control diet.*
- 5. The average of apparent nitrogen retained was higher with broilers fed the control diet than those fed diets contained B.T.rice straw or wheat bran.*

Although, there was no significant difference in average nitrogen balance between broilers fed diets contained B.T.rice straw and wheat bran.

- 6. The highest calcium and phosphorus balance recorded with broilers fed diets containing 35% and 30% B.T.rice straw, respectively; while the lowest value was recorded with 35% wheat bran. On the other hand, the highest values of tibia calcium and phosphorus were observed with broilers fed diets contained 20% B.T.rice straw. The highest value of tibia ash recorded with those fed 15% B.T.rice straw. While the lowest value was recorded from those fed the control diet.*
- 7. The relative economical efficiency ranged between 102.7% and 139.7% for chicks fed diets contained 15% B.T. rice straw and 40% wheat bran, estimated by those fed the control diet (100%).*

**INFLUENCE OF DIETARY PHYTASE ON BROILERS PERFORMANCE FED LOW-
PHOSPHORUS CORN/SOYBEAN OR SUNFLOWER DIETS BASED ON DIGESTIBLE OR
DEFICIENT AMINO ACIDS**

By

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Abstract: *Two experiments were conducted to investigate the influence of using microbial phytase with low-nPP diets on broiler performance. Experiment I, was conducted to investigate the using of two dietary protein sources soybean meal (SBM) and sunflower meal (SFM), two levels of microbial phytase (0 and 750 FTU/kg). A positive control diet (adequate in non-phytate phosphorus (nPP) 0.45/0.35% (at starter and grower period) and Ca level 1%) and based on total (TAA) and digestible (DAA) amino acids; methionine (Met) and lysine (Lys). A total number of 360 unsexed one-day old, Arbor Acres broiler chicks were randomly and equally distributed into 12 treatments of 30 chicks each, in three replicates (10 chicks, each).*

The experiment II, Two hundred and forty-unsexed, one-day old Arbor Acres broiler chicks were distributed into 8 treatments of 30 chicks each, in three replicates (10 chicks, each). A 2 × 2 × 2 factorial arrangement of treatments was used with two dietary protein sources (SBM and SFM), two levels of microbial phytase (0 and 750 FTU/kg) and adequate (NRC,1994) or deficient amino acids levels (Met and Lys). The level of Ca in low-nPP diets plus phytase (750 FTU/kg diet) was 0.6%. Results obtained are as follows:

Exp. I: The low-nPP without phytase supplementation diets caused a negative effect on growth performance ($P<0.01$), plasma P level, tibia weight and mineral retention compared to those fed the control diet or low- nPP diets plus phytase. Phytase supplementation to low- nPP diets improved broilers performance, nutrients digestibility coefficients, economic efficiency and increased plasma P level ($P<0.01$), tibia weight and mineral retention, and decreased plasma ($P<0.01$) Ca, Zn, and Mg levels compared to those fed low- nPP diets without phytase. Chicks either fed diets based on DAA or corn/ sunflower meal recorded ($P<0.01$) the best growth performance and higher ($P<0.01$) plasma P, Ca and Mg levels compared to those fed TAA or corn /soybean meal.

Exp. II: Chicks fed diets deficient in AA recorded the lowest growth performance. Phytase supplementation to low-nPP diets improved broiler performance, minerals retention, economic efficiency and digestion coefficient of CP and NB. Phytase supplementation of low-nPP diets supplemented with AA (Met and Lys) recorded a comparable growth performance with chicks fed control diet. Chicks either fed diets based on adequate in AA or corn/soybean meal increased ($P<0.01$) BWG, breast meat and Mg concentrations and improved FC and economic efficiency and decreased abdominal fat percentage compared to those fed diets deficient in AA or corn/sunflower meal diets.

SOME PRODUCTIVE AND PHYSIOLOGICAL RESPONSES TO DIETARY *NIGELLA SATIVA* SEEDS SUPPLEMENTATION OF MAMOURAH LAYING HENS.

By

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Abstract: *The present study was aimed to investigate the effect of dietary supplementation of different crushed Nigella Sativa seeds (NS) levels and two feeding regimes on some productive performance and physiological parameters in Mamourah laying hens. One hundred and five, 28 – weeks old, Mamourah hens were divided into five equal groups according to the following design: group A: received the control diet ; group B and C: received control diet plus 0.75% and 1.5 % crushed black seeds, respectively which given continuously for 12 weeks(28-40 wks). Whereas groups D and E received the same levels of NS seeds 0.75 and 1.5 %, but with an intermittent feeding 15:15 days system for the same period.*

The results indicate that, final body weight, body weight gain and egg weight were significantly ($P \leq 0.001$) increased , but production efficiency, egg number , hen day percentage, egg mass (g / hen / day), economical efficiency percentage, feed intake (g / hen / day) and feed conversion were decreased by addition of 0.75% crushed NS seeds in continuous supplementation. However, inclusion of 1.5 % crushed NS seeds in the diet had no significant effect on final body weight, body weight gain and production efficiency in both continuous and intermittent feeding systems as compared with the control group. The addition of crushed NS seeds to the diet significantly ($P \leq 0.001$) reduced cholesterol and total lipids levels in serum and yolk. Shell weight and percentage, yolk index, Haugh Units score, and specific gravity were significantly ($P \leq 0.05$) increased by dietary level of 0.75% crushed NS seeds in both continuous and intermittent feeding systems. However, dietary level of 1.5% crushed NS seeds had no effect as compared with control. Egg weight, yolk weight, yolk percentage, and yolk index were significantly ($P \leq 0.001$) increased, while Haugh Units score, albumen percentage, and shell thickness were significantly ($P \leq 0.001$) decreased with advancing production interval. Hen day percentage, feed intake, and egg mass (g / hen/ day) were significantly increased ($P \leq 0.001$). While the egg number increased ($P \leq 0.05$) to reach the maximum during the period 32 –36 weeks of age and then decreased with advancing production interval. Concentration of cholesterol and total lipids in serum and yolk were significantly decreased by advancing of production intervals.

It could be concluded that addition of crushed NS seeds in layer diets may produce eggs with low cholesterol and total lipids content. These eggs may be more desirable for consumers, especially those suffering from heart disorders.

THE RESPONSE OF LAYING HENS TO CORN-SOYBEAN MEAL DIETS SUPPLEMENTED WITH METHIONINE AND LYSINE

By

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Abstract: A total number of 160 Bovans brown commercial egg type (24 weeks of age) were used to study the influence of dietary protein level with or without methionine and lysine supplementation on their performance from 24 to 43 weeks of age. The birds were randomly distributed into eight treatment groups of 20 hens each with 5 replicates, each of 4 birds. Birds of all experimental groups had nearly the same initial average live weight and average egg production. Two laying corn-soybean diet were formulated to be isocaloric (2700 K cal ME/kg feed) and contained either 16.00 or 17.60% crude protein. DL- Methionine at levels of 0.0, 0.05 or 0.1% and lysine at levels of 0.0 or 0.12% were added either alone or in combination (0.05% DL-methionine + 0.12% lysine or 0.1% DL-methionine + 0.12% Lysine) to the diet with 16% CP, while DL-methionine at levels of 0.00 or 0.05% was added to the diet with 17.6% crude protein.

The obtained results could be summarized as follows:

Live body weight of laying hens at the end of the experimented period (43 weeks of age) was insignificantly affected among treatments.

Addition of 0.05% methionine and 0.12% lysine to 16.0% protein diet (hens consuming 354 mg methionine, 1029 mg lysine and 17.15 g protein/hen/day) significantly ($P < 0.05$) recorded better feed intake (g), feed conversion (g feed/g egg) protein intake (g) and protein utilization efficiency (PUE) than the other treatments during the whole period (24 – 43 weeks of age).

Addition of 0.1% methionine and 0.12% lysine to 16% protein diets (hens consuming 434 mg methionine, 1097 mg lysine and 18.28 g protein/hen/day) significantly ($P < 0.05$) improved egg production %, egg mass (g) and recorded better economical efficiency during all period (24- 43 weeks age). While, the highest egg weight was obtained with the diet containing 17.6% CP supplemented with 0.05% methionine (hens consuming 340 mg methionine, 1087 mg lysine and 19.92 protein/hen/day) during the same period.

No significant differences were observed in egg quality [albumen, yolk and shell weight (g) and shell thickness (mmx100)] at 39 or 43 weeks of age due to dietary treatments.

Although the level of 18% CP is recommended by NRC (1994) to meet the nutrients requirements of laying hens, however, methionine at 0.1% and lysine at 0.12% could be supplemented to the diet containing 16% CP, 0.28% methionine and 0.84% lysine. without any deleterious effects on productive performance and economical efficiency of laying hens.

CAPABILITY OF MANNAN-OLIGOSACCHARIDE (BIO-MOS(R)), ORGANIC SELENIUM AND HYDRATED SODIUM CALCIUM ALUMINOSILICATE TO DETOXYIFY AFLATOXICOSIS FOR GROWING LOCAL CHICKENS.

2- Lymphoid organs, Immune response and residues in tissues.

By

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Abstract: A total number of 270 unsexed El-Salam chickens at two-weeks of age were used in this study. Chickens were randomly assigned for six treatments (45 bird each). Chickens of the 1st group served as control . Chickens of the 2nd group was received the basal diet contaminated with 1 mg Aflatoxin B₁ (AFB₁)/ kg diet . The 3rd , 4th , 5th and 6th groups were received AFB₁ – diet supplemented with 1g Bio-Mos^(R), 0.5 mg selenomethionine (Se), (1g Bio-Mos + 0.5 mg Se/kg diet) or 0.25% Hydrated sodium calcium aluminosilicate (HSCAS), respectively, for 6 weeks treatment period , After 6 weeks of treatment, chickens were allowed without any treatment for other 4 weeks as recovery period.

Main results obtained can be summarized as follows:-

1- Bursa of fabricius and thymus glands relative weights, hemoglobin (Hb), concentration Red blood cell (RBCs), white blood cell (WBC's) and packed cell volume (PCV%) were significantly decreased in chickens fed diet with AFB₁.

2- The geometric mean of HI antibody response to Newcastle disease vaccines (NDV) did not differ significantly between the AFB₁-diet and control diet during the treatment period .

3-High values of AFB₁ residue was found in liver tissues than that in meat .

4-Bio-MOS and /or Se or HSCAS to aflatoxin contaminated diets decreased residues of AFB₁ in liver and meat compared with control diet. After 4 weeks recovery period, the level of AFB₁ residue was decreased by 57- 88 % in liver for all aflatoxin groups compared with treatment period, while AFB₁ was absent from meat at the end of recovery period .

5- Chickens fed diet contaminated with AFB₁ showed sever signs of low viability, anorexia, perosis, atoxia, acattered feathering and nasal haemorrhage. However, these signs were decreased in chicks when Bio-Mos, Se or HSCAS was supplemented and further improvement was occurred due to a combination of Bio-Mos plus Se. Also, most of these sings were recovered during the 4th week of the withdrawal period especially for chicks fed AFB₁ plus Bio-Mos plus Se.

Bio- Mos , Se or HSCAS decreased aflatoxicosis of chickens fed diet contaminated with AFB₁ especially , when Bio – Mos and Se was combined during the exposure period and helped to fasten during the recovery period .

EFFECT OF REPLACING YELLOW CORN BY BAKERY BY-PRODUCT ON BROILER PERFORMANCE

BY

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Abstract: This study was conducted to investigate the effect of replacing yellow corn (YC) by bakery by-product (BBP) on growth performance, carcass traits, blood constituents and economical efficiency of broiler chicks. Three hundred un-sexed Arbor-Acres broiler chicks at one-week of age were divided into ten treatments (30 bird each), each treatment contained 3 replicates of 10 birds each. The experimental treatments were as follows:

Treatment 1 (T₁) A corn soybean diet and taken as a control (NRC requirements).

Treatment 2 (T₂) 25% of YC in T₁ was replaced by BBP (adjusted to NRC energy requirements).

Treatment 3 (T₃) 25% of YC in T₁ was replaced by BBP (non adjusted to NRC energy requirements).

Treatment 4 (T₄) T₃ plus .05 % Xylam (B-xylanase and α -amylase).

Treatment 5 (T₅) 50% of YC in T₁ was replaced by BBP (adjusted to NRC energy requirements).

Treatment 6 (T₆) 50 % of YC in T₁ was replaced by BBP (non adjusted to NRC energy requirements).

Treatment 7 (T₇) T₆ plus .05 % Xylam.

Treatment 8 (T₈) 75% of YC in T₁ was replaced by BB (adjusted to NRC energy requirements).

Treatment 9 (T₉) 75 % of YC in T₁ was replaced by BBP (non adjusted to NRC energy requirements).

Treatment 10 (T₁₀) T₉ plus .05 % Xylam.

Live body weight (LBW): Chicks fed diet 10 had the highest values of LBW at 14 and 21 days of age, and. Chicks fed diet 7 had the highest values of LBW at 28, 36 and 42 days of age. Live body weight gain (LBWG): Chicks fed diet 7 had the

heaviest LBWG during the periods from 7 to 28 and 7 to 42 days of age, while chicks fed diet 10 had the heavier LBWG during the period from 29 to 42 days of age as compared with the control (diet 1) and the other diets at the some periods. Feed intake (FI): Chicks fed the control diet had the lowest FI during the periods from 7 to 28, 29 to 42 and 7 to 42 days of age. Feed Conversion(FC), crude protein conversion (CPC) and caloric conversion ratio (CCR): Chicks fed diet 2 had the best FC and CPC during the periods from 29 to 42 and 7 to 42 days of age. Whereas, chicks fed diet 10 had the best CCR during the periods from 29 to 42 and 7 to 42 days of age. Growth rate (GR): Chicks fed diet 7 had higher GR values at the two periods(7 to 28 and 7 to 42 days). Carcass characteristics: Chicks fed the control diet had the highest value of abdominal fat whereas, chick fed diet 10 had the lowest value of abdominal fat as compared with the control or the other groups. Serum constituents: Chicks fed diet 7 had the highest value of GOT, total protein and albumin. Chemical composition of broiler meat: The highest fat% value was observed for the group fed diet 4, while the lowest fat % value was observed for the group fed diet 10. Carcass part significantly affects ($P \leq 0.01$ and $P \leq 0.05$) protein, fat, ash and NFE %. Front part had higher protein, ash and NFE % than rear part, while, rear part had a higher fat % than front part. Mortality%: Obtained results indicated that the percentage of mortality was 3.33 % in chicks fed diet 1,5 and, 8 as compared with the other groups during the starting period. Whereas, chicks fed diets 3 and 6 had the highest mortality % during the finishing and total periods. Economical efficiency (EEF): Chicks fed diet 9 gave the best economical and relative efficiency then chicks fed diet 6 when compared with the other treatments or the control. Whereas, the birds fed the control diet had the worst values. It can be concluded that BBP can be replaced from YC at level 75% in broiler diets to get best performance and highest income per chicken.

EFFECT OF DIETARY MOLASSES ON GROWING CHICKS PERFORMANCE REARED ON TWO LITTER TYPES IN HOT CLIMATE

BY

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Abstract: *The objective of this experiment was to study the impact of dietary molasses supplementation on the performance of male and female Dandarawi chicks reared on two types of litter in hot climate in the summer months (June-July-August) of Upper Egypt (Assiut Governorate). Six hundred and thirty 8 weeks of age Dandarawi chicks were used. Chicks were randomly distributed into three groups (210 chicks/group) of three replicates each (70 chicks each, 35 male and 35 female). Birds in group 1 fed the control diet and reared on wheat straw litter (WS). Birds in group 2 fed on the experimental diet (i.e. control diet supplemented with 4 % molasses) and reared on wheat straw litter (WSM). Birds in group 3 fed on the control diet supplemented with 4 % molasses and reared on sand litter (SM).*

Results indicated that the males and females of chickens reared on SM and fed diets containing 4% molasses had significantly ($P<0.05$) higher body weight than WS and WSM groups at all ages studied. Body weight at 20 weeks of age of the SM group was significantly ($P<0.05$) higher by about 15.4 and 7.7% of males and 21.7 and 10.3% of females than those of WS and WSM groups, respectively. The males and females of the SM group significantly gained ($P<0.05$) more than those of the WS and WSM groups at 8-12 weeks of age, respectively, while the males and females of WSM group significantly gained ($P<0.05$) more than those of WS group. The overall mean males of SM group showed a significantly ($P<0.05$) higher daily weight gain by about 27.3 and 8.7 % than those of WS and WSM groups, respectively, while the males of WSM group showed significantly ($P<0.05$) higher daily weight gain by about 17.1 % than those of WS group. The average of feed consumption revealed that SM group consumed significantly ($P<0.05$) higher feed by about 9.3 and 8.1% as compared with those of WS and WSM groups respectively. The overall mean of feed conversion in SM groups was significantly ($P<0.05$) improved by about 24.4 and 18.3 %, respectively as compared with those of WS and WSM groups, while no significant differences in feed conversion between WS and WSM groups were observed. The males and females of SM group had significantly ($P<0.05$) higher carcass weight, tibia bone length and tibia bone diameter than those of WS and WSM groups except tibia bone diameter of females. Males of SM group had significantly ($P<0.05$) higher percentages of femurs and drumsticks than those of WSM group, but the males of WS group had an intermediate estimate. No significant differences in plasma concentrations of albumin, aspartate transaminase (AST), alanine transaminase (ALT) and calcium of males and albumin, AST and calcium of females were found among all groups. Males and females of WSM and SM groups recorded significantly ($P<0.05$) lower plasma glucose than those of WS group.

It is concluded that the males and females Dandarawi chicks reared on sand litter and fed dietary molasses at level of 4% had significantly ($P<0.05$) higher body

weight, body weight gain, feed consumption, carcass yield and enhanced feed conversion ratio as compared with control birds reared on wheat straw litter and fed free molasses diet under hot climate of Assiut Governorate.

IMPROVING THE UTILIZATION OF WHEAT BRAN IN QUAIL DIETS

By

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Abstract: *This work was conducted at the Poultry Research Station, El-Azaab, Fayoum, Egypt, to study the possibility of improving the utilization of wheat bran in quail diets. A total number of 640 one week old unsexed Japanese quail chicks were divided into 8 equal treatments (80 birds each) of approximately similar in body weight. Treatment 1 received the control diet containing 24.03% CP and 2896 kcal ME/kg. Treatment 2 was received the basal wheat bran diet (WB-diet) containing 24.00% CP and 2360 kcal ME/kg. Treatments 3,4,5,6,7 and 8 were received the WB-diet supplemented with either 1% radish extract (RE), 1% RE + 0.1 % Avizyme 1500 (E), 1% RE + 1.0% sodium sulphate (SS), 0.1% E, 1% SS or 1% SS+0.1% E, respectively.*

All feed additives at 3 weeks of age increased body weight and to some extent improved feed conversion. At 6 weeks of age there was insignificant differences between all dietary treatments. In laying phase (8-20 weeks), all feed additives improved egg number, egg mass and feed conversion compared to the birds fed WB-diet alone. The combination of RE+E, RE+SS and SS+E improved hatchability percentage compared to the birds fed either WB-diet alone or those fed the control diet. It could be concluded that RE, E or SS alone or in combinations can be used to improve the utilization of 30% wheat bran in quail diets in both growing and laying phases.

INFLUENCE OF USING BAKER'S YEAST AND MICROBIAL PHYTASE IN JAPANESE QUAIL DIETS ON PRODUCTIVE PERFORMANCE AND SOME PHYSIOLOGICAL PARAMETERS

BY

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Abstract: *This research was performed at the Poultry Research Station, El-Azab, Fayoum, Egypt. The target of the present research was to study the benefit and impact of incorporating baker's yeast (BY, *Saccharomyces cerevisiae*) and / or exogenous microbial phytase (Ph) as a feed additives over the low-P diet on productive performance of Japanese quails. A total number of two hundred and forty three unsexed one-week old Japanese quail chicks were used. They were randomly distributed into nine experimental dietary groups, each dietary group was subdivided into three replicates equal in number. Two types of diets were used, the control diet included sufficient available P and the other type, the basal diet contained low P (low-P diet). The control and the low-P diets of both the growing and the laying periods included 0.52, 0.25, 0.49 and 0.24% available P, respectively. These diets also, were prepared to be isonitrogenous and isocaloric, 24% CP and 2900 kcal ME/kg diet for grower, and 20% CP and 2900 kcal ME/kg diet for laying period according to NRC (1994) recommendation. Nine experimental diets were formulated during both the growing and the laying periods, which were lasted for 6, and 10 weeks, respectively. The different nine experimental diets were as follow: diet 1 (the control diet), diet 2 (1g BY/kg low-P diet), diet 3 (1g BY+600FTU/kg), diet 4 (1g BY+1000FTU/kg), diet 5 (1.5g BY/kg), diet 6 (1.5g BY+600FTU/kg), diet 7 (1.5g BY+1000FTU/kg), diet 8 (600FTU/kg) and diet 9 (1000FTU/kg low-P diet). From the results obtained through the entire experimental period, it could be concluded as follows:*

1- Inclusion of baker's yeast (up to 1.5 g/ kg), or phytase (up to 1000 FTU/kg) over the low-P diets, ameliorated the utilization of P and other nutrients conjugated with phytate in the diets of quail chicks without any decline impacts on productive performance, carcass characteristics, economical efficiency and alleviated indirectly the environmental pollution by lowering the excreted organic P into the litter of livestock

2-Addition of 1.5g baker's yeast plus 600 FTU/kg low-P diet of quail layers, increased both egg weight (EW), egg production (EP), egg mass (EM), feed intake (FI) and ameliorated feed conversion (FC).

3-Incorporation of dietary phytase over the low-P diet of quail layers at 1000 FTU/kg, considered an important factor for enhancing EW, EP, EM, FI and improved FC.

4-Adding 1.5g baker's yeast plus 600FTU/kg over the low-P diet of quail layers could be realized the cheapest feed cost/egg and also, would be given the best economical efficiency of egg production without any adverse impact on productive performance, fertility % and physiological and behavioral responses for quail layers.

RESPONSE OF BROILER CHICKS TO LOW PROTEIN DIETS SUPPLEMENTED WITH PROBIOTICS PREPARATIONS

BY

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Abstract: *The present study was performed to evaluate the effects of feeding low protein diets fortified with probiotics preparations on the performance of broiler chicks. Two hundred and forty, unsexed one-day old Arbor Acres broiler chicks were assigned to eight equal experimental groups, each had 3 replicates of 10 birds each. Two basal diets were formulated to contain the recommended (22 and 20%) and lower (20 and 18%) crude protein for starter (7-28 days) and grower (29-42 days), periods, respectively. Both starter and grower diets were either supplemented or not with any of the tested probiotics being Bio-Top (B), Organic Green Culture (G) and Avi- Bac (A), each at level of 1.5 g/kg diets. Accordingly, a completely randomized design in 4x2 factorial arrangement of treatments was applied. The obtained results can be summarized as follow:*

Regardless of dietary crude protein level, supplementing diets with probiotics significantly ($P \leq 0.05$) increased body weight gain and improved feed conversion compared to control birds fed probiotic- free diets. Birds fed low protein diets consumed significantly more feed and exhibited inferior feed conversion efficiency compared to those fed the recommended protein levels, whereas their body weight did not significantly affected.

Regarding to the interaction between crude protein levels and probiotics no significant differences were observed for criteria of growth performance and nutrients digestibilities. However, supplementing low protein diets with any of the used probiotics tend to improve feed conversion and digestibility of crude protein and crude fiber, as well as significantly lowered the coliform and total intestinal bacterial count, while increased that of lactobacillus.

The results of this study indicated that using either Bio-Top, Organic Green Culture or Avi-Bac at level of 1.5 Kg/ton diets spared nearly 2% crude protein of the recommended level for broilers. This result would be effective from the economical stand point of view, since protein is the most expensive feed nutrient in poultry feeding.

PERFORMANCE OF KUTTANAD DUCKS UNDER BACKYARD SYSTEM OF REARING

By

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Abstract: *Indigenous ducks in Kerala are reared extensively by foraging in post harvest paddy fields traditionally. Large number of ducklings is being produced in Alappuzha district and the grown up ducks are distributed among duck growers in other districts. The layer ducks are being reared in flocks of 500 to 5000 and the minimum flock size is 500 layers. The present study was carried by distributing 10 layer ducks each in 75 households in three districts. The results indicated that the duck housed egg number was 59.15, 78.24 and 73.88 eggs per duck in Trissur, Malappuram and Ernakulam districts respectively with corresponding duck housed per cent (DHP) production of 32.32, 42.75 and 40.37 upto 44 weeks of age during the period from June to November. A significant variation in egg production was observed due to variations in feeding system. The feasibility of rearing of ducks under backyard system of rearing was proved successful in Kerala.*

PRODUCTION TRAITS OF INDIGENOUS LAYER DUCKS FED HIGH FIBRE DIETS SUPPLEMENTED WITH POLYZYME

By

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Abstract: *An experiment was conducted to evaluate the performance of caged layer ducks (144) fed high fibre diets supplemented with Polyzyme, a cocktail enzyme preparation. The birds were divided into four groups of 36 ducks each having 3 replicates of 12 ducks each. A basal diet having 18% CP, 2650 kcal ME/kg and 8% CF was prepared and fed to T1. Paddy was added to basal diet to make a CF of 12% and fed to T2. Groups T3 and T4 were fed with diet T2 supplemented with enzyme at 0.1 and 0.2% levels respectively. The birds in the group T3 recorded superior performance with respect to duck housed number, duck housed per cent, feed efficiency, egg weight, egg mass and livability*

**STUDIES ON THE ECONOMIC VIABILITY OF LEAN SEASON
FEEDING OF KUTTANAD DUCKS UNDER FORAGING SYSTEM**

By

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Abstract: *A field trial was carried out in 1000 layer ducks to evaluate supplementary feeding of Jowar (Sorghum) grains and economics over egg production during the lean season. The monsoon rain period is the lean season in Kerala since the paddy fields are submerged. Four farmers with flocks size 250 each was chosen at four locations. Jowar (Sorghum) was supplemented @ 150g per duck per day for three months. The mean daily egg production from a flock of 250 ducks averaged 104.87, 154.06, 90.84 and 147.75 eggs with farmers I, II, III and IV respectively. The corresponding duck housed percent production was 41.95, 61.62, 36.34 and 59.10 per cent. The egg production recorded with farmer II and IV were significantly higher than those recorded with farmer I and III ($P < 0.05$). The supplementary feeding was found to be beneficial to maintain egg production. The farmers could earn a net profit of Rs. 50 per day from a flock of 250 ducks against 'Zero' returns with traditional method of providing only maintenance feed during lean season.*

EFFECT OF SEX RATIO ON SOME PRODUCTIVE AND REPRODUCTIVE TRAITS IN JAPANESE QUAIL

By

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Abstract: A total of 447 Japanese Quail chicks produced during three sex ratio were included in the present study to evaluate the effect of sex ratios among mating parents on some productive and reproductive traits. The results obtained can be summarized as follows:

- 1- Body weight recorded at hatch and 2 weeks of age increased significantly from (8.21, 33.17 gm), (8.01, 31.89 gm) in 1:2 and 1:3 sex ratios to 8.30 and 34.11 gm in 1:1 sex ratio. Similar trend was observed for average daily gain calculated during the growth periods from 0-2 and from 2-4 weeks of age.
- 2- Body weight recorded at 4 and 6 weeks of age increased significantly from (89.98, 150.01 gm), (85.17, 146.91 gm) in males and (103.71, 155.8 gm), (99.87, 151.02 gm) in females of 1:2 and 1:3 sex ratios to 91.91, 153.18 gm in males and 105.31, 161.38 gm in females of 1:1 sex ratio. Also, similar trend was observed for average daily gain recorded during the growth periods from 4-6 and from 0-6 weeks of age.
- 3 - Age at sexual maturity of females decreased significantly from 53.02, 55.13 days in 1:2 and 1:3 sex ratios to 51.91 days in 1:1 sex ratio.
- 4- Total egg number produced during the first 10 weeks of laying period increased significantly from 61.11, 59.81 eggs in 1:2 and 1:3 sex ratios to 61.72 eggs in 1:1 sex ratio. Similar trend was observed for total egg weight and daily egg mass produced among the first 10 weeks of laying period.
- 5- Fertility, hatchability and embryonic mortality percentages were significantly affected by sex ratio studied

MINIMIZING RESIDUAL FEED CONSUMPTION BY INTRODUCING DWARF AND NAKED NECK GENES IN LAYING CHICKEN

By

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Abstract: *An experiment was conducted to evaluate the effect of dwarf (dw) and naked neck (Na) genes in a single state or combination on feed efficiency and egg production parameters of laying hens under summer season of Egypt. Measurements related to efficiency of feed utilization for egg production were recorded between ages 20 and 40 weeks. Residual feed consumption (RFC) was estimated as the difference between observed feed consumption (OFC) and expected feed consumption (EFC) given by a multiple regression equation within feed consumption as dependent variable and egg mass, metabolic body weight ($BW^{0.75}$) and weight gain as independent variables. The current results revealed that the dw gene significantly reduced body weight, total egg number, egg mass and feed intake in either normal or naked neck genotype. With respect to Na gene, the results showed that the presence of Na gene increased total egg number, egg mass and egg weight compared to normally feathered sibs, but the differences were not statistically significant. Moreover, the incorporated Na gene into dwarfed birds compensated the negative effect associated with dw gene on egg production parameters. The presence of dw gene in a single state or combined with Na gene significantly improved feed conversion ratio compared to normal type. Similar trend was observed for Na gene, but the difference was not statistically significant. Concerning eggshell quality, the presence of dwarf (dw) and naked neck (Na) genes improved eggshell quality.*

The results revealed that the equation calculated for Nanadw- genotype had a better rate of determination ($R^2=0.69$) followed by nanadw- ($R^2=0.46$), NanaDw- ($R^2=0.35$) genotypes compared to nanaDw- sibs ($R^2=0.28$). It was generally noticed that the observed values of feed intake were closely to expected values in Nanadw-, nanadw- and NanaDw- genotypes compared to nanaDw- sibs. This adjacency was reflected on RFC, where it was more consistent to zero line. Positive relationships between RFC and egg mass were observed in nanadw- and NanaDw- genotypes. However, these relationship were inverse in nanadw- and Nanadw- genotypes. Both observed feed consumption and feed conversion ratio was highly significant positive correlations with RFC in all genotypes. The relationships between RFC and yolk percentage were positive in all genotypes.

In conclusion, *the current results suggest the incorporation of dw and Na genes into laying chickens led to improved feed efficiency by minimizing residual feed consumption. The results also suggested that more consideration should be given the difference among various genetic stocks in their requirements for maintenance and egg production. Moreover, it is possible to use of residual feed consumption as selection criteria for improve feed efficiency.*

**EFFECT OF TYPE OF LITTER AND DIETARY MOLASSES
SUPPLEMENTATION ON SOME DANDARAWI CHICK TRAITS
UNDER SUMMER SEASON CONDITIONS OF ASSIUT
GOVERNORATE**

By

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Abstract: Six hundred and thirty of 8 weeks of age Dandarawi chicks were used to study the effect of type of litter and dietary molasses supplementation on the performance, carcass parts, and economic efficiency during growth period under summer season conditions of Assiut governorate. All chicks were housed in floor pens in 3 equal groups (3 replicates of 70 birds each). Each replicate was kept in a partition of 10 square meters provided with light litter (5 cm). In group 1 which served as control one, the chicks reared on wheat straw litter (WS), while the other 2 and 3 groups reared on wheat straw litter or sand with 4% molasses supplementation to the diet (WSM and SM, respectively). The photoperiod was 12 hours per day and light intensity ranged from 20 to 25 Luxes, while feed and water were available all the time. The chicks received grower diet until 20 weeks of age. The indoor temperature and humidity ranged between from 25-38°C and 40-66%, respectively.

The obtained results could be summarized as follows:

The birds reared on SM had significantly ($P \leq 0.05$) heavier body weight (BW) and daily weight gain (BWG) and it also observed that the overall mean of feed consumption (FC) decreased ($P \leq 0.05$) than those of WS and WSM. The birds reared on SM showed improved ($P \leq 0.05$) feed conversion ration (FCR) than those of WS, while WSM group had an intermediate estimate. The birds of SM and WSM groups had significantly ($P \leq 0.05$) heaviest the percentages of carcass and liver as compared to the birds of WS group. The birds of group SM had significantly ($P \leq 0.05$) lower percentages of feet and shank, head, heart, gizzard and proventriculus than those of WS and WSM groups, it also showed significantly ($P \leq 0.05$) higher carcass weight and tibia bone length and diameter than those of WS and WSM groups. The birds reared on SM and WSM exceeded in WS control the economical efficiency by 17 and 21%, respectively. In general, sand with 4% molasses supplementation to diet has shown good potential as alternative wheat straw with or without 4% molasses supplementation to diet for growing Dandarawi birds during high environmental temperature of summer season in Assiut governorate.

**THE EFFECTS OF SLOW FEATHERING GENE (k) ON PRODUCTIVE PERFORMANCE
OF DANDRAWI CHICKENS UNDER SUBTROPICAL CONDITIONS**

By

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Abstract: *Data of 369 Dandrawi laying hens (23-74 wks) which represent two genotypes namely slow feathering (K/-) and rapid feathering (k/-) were used to evaluate the effect of sex-linked K gene on the productive performance. The results obtained can be summarized as follow:*

- 1- *The rapid feathering pullets (k/-) reached to sexual maturity earlier than slow feathering (K/-) by about 4 days. The presence of K allele led to a significant reduction ($P < 0.01$) in egg number till 90 days and throughout the production cycle (23-74 wks) by about 16.20% and 12.90%, respectively.*
- 2- *A significant reduction in egg weight and total egg mass due to presence of K allele was 3.60% and 15.60%, respectively.*
- 3- *The slow feathering birds (K/-) were lower body weight at 24, 40, 52 and 72 wks of age by about 19.70%, 7.50%, 11.90% and 9.90% than their rapid feathering counterparts, respectively. Mortality rate due to K allele within the production cycle increased by 47%.*
- 4- *There were no significant effects due to feathering type on albumen and yolk percentages, whereas the eggs from slow feathering birds exhibited a significant reduction in egg shell quality.*
- 5- *The presence of K allele reduced significantly feather percentage by about 27.50%. Also, it reduced carcass and dressing percentages by about 5% and 4%, respectively. Only the K allele increased abdominal fat by about 28.50%.*
- 6- *The slow feathering birds had a remarkable reduction in ovary, oviduct and serum calcium level without any significant effect due to feathering type on serum phosphorus level. The slow feathering females had lower body temperature by about 0.3°C than their rapid feathering counterparts.*

PRODUCTIVE PERFORMANCE OF BOVANS BROWN AND HY-SEX BROWN LAYING HENS AS AFFECTED BY BODY WEIGHT AT 20 WEEKS OF AGE

By

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Abstract: Two hundred and fifty two from Bovans brown (BV) and Hy-sex brown (HS) pullets at 20 weeks of age were used in this experiment. Each strain included one hundred and twenty six of hens were classified according to body weight (X); into three category groups (42 hens of each) being heavy body weight averaged (1440 and 1740 g), medium body weight (standard body weight, 1323 and 1647 g) and light body weight (1236 and 1547 g) in Bovans brown and Hy-sex brown pullets, respectively. The hens of each group divided into six replicates (7 birds each). Each replicate was kept in wire cage (7 hens per cage) for 68 weeks of age.

The obtained results could be summarized as follows:

The medium birds of Bovans Brown strain (MBV) showed significantly ($P \leq 0.05$) higher hen day egg production (HDP) by 4.0 and 5.4%, hen housed egg production (HHP) by 4.0 and 12.3%, eggs number (EN) by 13.4 and 18.4 eggs and egg mass by 0.90 and 1.38 kg/hen and exceeded economical efficiency by 17.5 and 16.2% as compared with those of heavy and light birds of Bovans brown (HBV and LBV), respectively. The HBV showed a significantly ($P \leq 0.05$) higher egg weight (EW) by about 1.8 and 2.4% and feed consumption by 2.5 and 4.4% as compared with that of MBV and LMV, respectively.

The heavy and medium birds of Hy-sex brown strain (HHS and MHS, respectively) showed significantly ($P \leq 0.05$) higher HDP by 5.0 and 5.2%, HHP by 8.6 and 8.8%, EN by 16.9 and 17.6 eggs, EW by 1.8 and 1.5%, EM by 1.26 and 1.16 Kg/hen, FC by 2.1 and 1.1% and EE by 14.9 and 18.3%, respectively as compared with that of light birds of Hy-sex brown (LHS).

There were no significant differences in cumulative feed conversion (g feed/ g egg mass or g feed/ 12 eggs) among three body weight categories of both BV and HS strains. No deaths occurred of high and medium birds of both BV and HS strains at all ages, while the mortality rate was 8.0 and 4.8% for LBV and LHS, respectively.

It could be concluded that, the medium birds (standard body weight) of BV and medium and heavy birds of HS recorded the best EE value as compared with the other body weight categories.

**SELECTION AND CORRELATED RESPONSE FOR EGG
PRODUCTION TRAITS IN INSHAS AND SILVER MONTAZAH
STRAINS OF CHICKENS**

By

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Abstract: *Two local strains of chickens selected two generations for increasing egg number up to 40 wks of age (Inshas strain) and egg weight at 40 wks of age (Silver Montazah strain) were used to study the changes in egg number and egg weight after selection and to estimate correlated responses and genetic parameters of some economic traits. The results of selection for egg number at 40 wks of age showed significant differences between selected and control lines as well as among generations. The realized and expected response were 15.2 and 5.33 eggs over two generations. The direct selection for egg weight at 40 wks of age showed also highly significant differences among generations as well as selected and control lines. Moreover, the realized and expected response were 3.70 and 3.19gm over two generations. Heritability estimates for egg number at 40 wks of age in Inshas strain based on sire, dam and sire plus dam components of variance were 0.20, 0.32 and 0.29, respectively, the corresponding estimates of egg weight at 40 wks of age in Silver Montazah strain were 0.52, 0.92 and 0.72, respectively. Negative genetic and phenotypic correlations were observed between egg number at 40 wks of age and age at sexual maturity, duration period of the first ten eggs, egg weight and feed conversion. However, positive correlations between egg weight at 40 wks of age and body weight at sexual maturity, age at sexual maturity, duration period of the first ten eggs and egg mass, while negative correlations with egg number and feed conversion were detected.*

Generally, according to the results of the present experiment, it could be noticed that selection for increasing egg number at 40 wks of age in Inshas strain increased egg number and egg mass as well as improved feed conversion and reduced age at sexual maturity and duration period of the first ten eggs. However, selection for high egg weight at 40 wks in Silver Montazah strain increased egg weight, egg mass, age at sexual maturity and duration period of the first ten eggs, and improved body weight and feed conversion. Finally, selection program is suggested to be put to improve the egg productive performance of Inshas strain (as a new local strain) and crossed it with Silver Montazah strain to produce a commercial hybrid used in rural production

PHYSIO-BIOCHEMICAL CHANGES AND HISTOLOGICAL STATUS OF THE HEAT -STRESSED RABBIT BUCKS AND ITS AMELIORATION USING VITAMIN E AND SELENIUM UNDER EGYPTIAN CONDITION

By

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Abstract: Forty New-Zealand White (NZW) rabbit bucks were used. In the summer season, heat –stressed rabbit bucks were divided into four groups (10 each). The first group was kept as control group. The second, third and fourth groups (treated), were injected intramuscularly with vitamin E (100 IU/head), selenium (0.1 mg/kg body weight) and selenium plus vitamin E weekly at the same dose of the previous groups, respectively. Body thermoregulation, blood haematology and blood components of the summer heat- stressed rabbit bucks (control group) and treated with Vit. E or Se and Vit. E plus Se, were recorded. Histological status of the liver and kidney, were also observed.

The results showed that, rectal temperature was significantly ($P<0.05$) lower, while ear lobe temperature and skin temperature were insignificantly lower of the summer heat-stressed NZW bucks injected with Vit. E or Se alone and Vit. E plus Se than the control group, whereas respiration rate was significantly ($P<0.05$) lower with the bucks injected by Vit. E plus Se. Haemoglobin concentration (Hb), percentage of packed- cell volume (PCV), red blood cells (RBC's) and white blood cells (WBC's) were significantly ($P<0.05$) higher of the summer heat–stressed NZW bucks injected with Vit. E alone or Vit. E plus Se than those injected with Se alone and the control group. Total protein and albumin concentrations in the blood plasma were significantly ($P < 0.05$) lower of the summer heat-stressed rabbit bucks (control group) and injected with Se alone than those injected with Vit. E alone or Vit. E plus Se. Globulin and urea- N concentrations were significantly ($P<0.05$) lower of the summer heat–stressed NZW bucks injected with Vit. E alone or Vit. E plus Se than those injected with Se alone and or control group. Cholesterol concentration was significantly ($P<0.05$) lower of the summer heat–stressed NZW bucks injected with Vit. E or Se alone and Vit. E plus Se than the control group. However, creatinine and total lipids concentrations were significantly ($P<0.05$) higher of the summer heat-stressed rabbit bucks injected with Vit. E plus Se than those injected with Vit. E or Se alone and the control group. Testosterone concentration was significantly ($P<0.05$) higher, while cortisol concentration was significantly ($P<0.05$) lower of the summer heat–stressed NZW bucks injected with Vit. E or Se alone and Vit. E plus Se than the control group. Sodium concentration was significantly ($P<0.05$) higher, while potassium, calcium and total phosphorus concentrations were significantly ($P<0.05$) lower of the summer heat-stressed rabbit bucks (control group) than those injected with Vit. E or Se alone and Vit. E plus Se. Aspartate-aminotransferase (AST) and alanine-aminotransferase (ALT) activities were significantly ($P<0.05$) higher of the summer heat- stressed NZW bucks (control group) and injected with Se alone than those injected with Vit. E alone and Vit. E plus Se. Acid phosphatase (ACP) and alkaline phosphatase (ALP) activities were significantly ($P<0.05$) higher of the summer heat- stressed NZW bucks (control group) than those injected with Vit. E or Se alone and Vit. E plus Se, however, lactic dehydrogenase (LDH) activity was insignificantly higher. Histological status of the liver and kidney of the summer heat–stressed NZW bucks injected with Vit. E or Se alone and Vit. E plus Se were improved as compared to the control group.

**PRODUCTIVE PERFORMANCE, SOME PHYSIOLOGICAL
PARAMETERS AND IMMUNE RESPONSE IN LOCAL LAYING
HENS FED DIETS SUPPLEMENTED WITH YEAST
PREPARATION**

By

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Abstract: *This experiment was conducted to investigate the effect of yeast preparation supplemental to the diets on growth, productive performance, physiological parameters and immune response of two local strains Gimmizah and Mamourah. A total number of three hundred laying hens at 28 weeks (150 Gimmizah and 150 Mamourah strain) were individually caged in an open sided building and divided into five dietary treatments for each strain, each treatment consisted of three replicates each of 10 birds. A commercial layer diet was used as the control basal diet group (I), group II diet containing basal diet plus one gm Bio-Buds (BB)/kg diet, group III diet containing basal diet plus two gm Bio-Buds (BB)/kg diet, group IV diet containing basal diet plus one gm yeast (Y)/kg diet and group V diet containing basal diet plus 2 gm yeast/kg diet. The main results could be summarized as follows:*

- *The addition of 1 or 2 gm (BB)/kg diet significantly decreased feed intake, and improved feed conversion and egg weight.*
- *The addition of either yeast preparations (BB or Y) 1 or 2 gm/kg diet improved significantly fertility and hatchability percentages in addition to hatched chick weight.*
- *Adding 1 or 2 gm BB to the layer diets had significantly decreased on yolk cholesterol level and serum cholesterol level at 40 weeks of age.*
- *Significant differences were detected in serum AST and ALT levels in all groups ($P < 0.05$).*
- *Hens fed diet containing 1 or 2 gm BB/kg diets were recorded the best significant value of antibody production at 40 weeks of age.*
- *Hens fed diets containing 2 gm BB or 1 gm Y/kg diet had significantly increased ($P < 0.05$) in serum total protein and globulin level.*
- *The histopathological results indicated that the lesions in the liver and spleen were parallel with the addition 2 gm Y/kg diet (group V) of the Mamourah laying hens and 2 gm BB or 1 gm Y or 2 gm Y/kg diet (group III, IV and V) of the Gimmizah laying hens.*

EFFECT OF USING CANOLA SEED MEAL AND OIL IN LAYING HEN RATION ON ESSENTIAL FATTY ACID AND CHOLESTEROL CONTENTS OF EGG YOLK

By

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* Part of Ph. D thesis for the second author.

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Abstract: Two experiments were conducted at the Poultry Farm of the Animal Resources Department, College of Agriculture, University of Baghdad. The first experiment included 72 ISA-Brown strain hens, 30 weeks old. Hens were randomly assigned to six replicates (3 hens/replicate). The birds were fed different levels of canola seed meal (0 , 10 , 15 , 20%) in their diet.

In the second experiment 54 laying hens were fed diets containing 0 , 1.5 , 3% canola oil.

Results showed that using canola seed meal up to 15% in laying diet did not affect cholesterol content of egg yolk. Whereas , level of cholesterol decreased by increasing level of canola seed meal in the diet up to 20% . No significant difference in the level of egg yolk cholesterol was found when 1.5 and 3% of canola oil were used. From those experiments fatty acid contents of egg yolk reflected the levels of the fatty acids in the diet.

Thesis Abstract

STUDIES ON POULTRY HUSBANDRY

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The present investigation was conducted in poultry farm of Al-Gimmizah Animal Production Research Station to study the effect of light programs and dietary protein levels on growth and laying performance of Gimmizah chickens during the growing and laying periods. A total 600 chicks, eight weeks old were randomly chosen and treated by two light programs and protein levels during three stages of the experimental period as follow :**(from 8 – 20 weeks of age)**: two different step-down photoperiod programs, (A): started with 15 h/d at 8 weeks old and decreased by 1 hour every 2 weeks up to 10 h/d at 20 weeks of age. (B): started with 14 h/d at 8 weeks old and decreased by 2 hours every 4 weeks to reach 10 h/d at 20 weeks of age. Birds fed two grower diets containing (20 and 15 %) and (18 and 13 %) as a high and low protein levels during the periods (8 – 12) and (12 – 20) weeks of age, respectively. **(from 20 – 32 weeks of age)** : Two different step-up photoperiod programs had been used throughout the the period 20 - 32 weeks of age, program (A) : started with 11 h/d at 20 weeks old and increased by 1 hour every 2 weeks to reach 16 h/d at 32 weeks of age. Program (B) : started with 12 h/d at 20 weeks old and increased by 2 hours every 4 weeks up to 16 h/d at 32 weeks of age. Two laying diets containing (16 and 14%) were used during this period as high or low protein level, respectively. **(from 32 – 52 weeks of age)** : Two different constant light –dark cycle of 24 hours programs were used throughout the period 32 – 52 weeks of age, (A) : (16 L : 8 D) and (B) : (14 L : 10 D). One ration protein level of 16 % was used during the last period (from 32 to 52 weeks). egg production traits, egg quality, fertility and hatchability percentages were studied during the laying period (from 20 – 52 weeks of age).

Results indicated that light programs and protein levels had no significant effect on growth measurements during the growing period. Age at sexual maturity significantly affected as a result of using step-down photoperiod programs, while protein levels had no any effect on age at sexual maturity. Egg production traits insignificantly affected by light programs or protein levels during the period 20 – 32 weeks of age. During the last stage (32 – 52 weeks), lighting programs significantly affected egg production traits from 36 – 44 weeks of age and feed conversion during the periods 32 – 40 and 44 – 48 weeks of age.

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