المحاضره الحاديه عشر – دراسات عليا

مقرر الاضافات الغذائيه

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مضادات التأكسد ANTIOXIDANTS

من المعروف أن تزنخ الدهون يؤدى ألي أضرار كثيرة في علائق الدجاج والرومي يمكن إيجازها في التالي:

1- تقلل قابلية الطيور للأكل ويتبعه قلة النمو وقلة الإنتاج.

2- تؤدى ألي وجود فوق الاكاسيد للأحماض الدهنية وخاصة غير المشبعة (البيروكسيدات) و تلك تسبب أضرار حيوية سمية وخاصة على الكبد.

4- تسبب إسهالا و اضطرابات معوية والتهابات معوية أيضا.

5- تؤدى الى تأكسد بعض الفيتامينات الذائبة فى الدهون وبالتالي تفقد هذه الفيتامينات نشاطها الفيتامينى.

**واكثر المركبات الدهنية تعرضا للتأكسد هي الأحماض الدهنية الحرة وخاصة غير المشبعة**

 وتعتبر مضادات التأكسد مثل **(BHA &DPPD )** مواد محسنة لنوعية العليقه بما تحفظه من محتواها الدهني من التلف و الضرر كما أنها قد تضاف إلى مسحوق أوراق البرسيم للحفاظ على الكار وتينات من التلف ومع دلك فان مضادات التأكسد فيما عدا فيتامين **( E )** ليست مواد غذائية بالمعنى العلمي للغذاء.

فهي عبارة عن مركبات كيماوية لها القدرة على منع أكسدة المواد العضوية عن طريق كونها مستقبل جيد لذرة الأكسجين أو بمعنى أخر للإلكترونات وبالتالي تقطع سير التفاعلات الكيماوية الخاصة بالأكسدة.

وبدأ أول استعمال مضادات التأكسد سنة 1924م حيث استعملت فقط لمنع أكسدة فيتامين ( A ) و ابتداء من سنة 1938 استخدمت هذه المركبات كإضافات للدهون غير المشبعة لتقدير درجة تأكسدها عن طريق معرفة كمية البيروكسيدات فيها و بالتالى كمية الأكسجين التي امتصها الدهن 0

وقد وجد أن فيتامين ( E ) وكثير التوكوفيرولات لها القدرة على حفظ وصيانة الدهون من التأكسد ؛ و اعتبرت بذلك ضمن مضادات التأكسد وهذه التوكوفيرولات تمنع تأكسد الدهون وتأكسد فيتامين ( A ) 0

بعض الإمراض الغذائية مثل مرض الارتشاح **EXUDATIVE DIATHESIS** ومرض الكتكوت المجنون أو الرخاوة المخية في الكتاكيت **ENCEPHALOMALCIA**  ومرض تنخر الكبد وغيرها؛ سببها الحقيقي والمباشر هو وجود هذه البيروكسيدات في الغذاء أو تكونها في الجسم من دهون أو أحماض دهنية نتيجة لتأكسدها و أن فعل مضادات التأكسد و خاصة فيتامين ( E ) العلاجي لهذه الأمراض ناتج عن منع هذه المركبات البيروكسيدية المسببة للمرض.

ويعتبر فيتامين ( C ) من مضادات التأكسد و لكن مفعوله مقصور على وجود البيروكسيدات داخل ألا نسجه وليس له فعل فيتامين ( E ) على الدهون في العليقه ؛ ومن المواد المانعة لتكوين البيروكسيدات أيضا ازرق الميثلين **METHELINE B LUE & NORDIHYDROGUARIARETIC .**

ومضادات التأكسد أيضا تحسن الاستفادة من فيتامين ( A ) فضلا عن منع تأكسده ؛ فهي تحافظ على الكاروتينات وبالتالي على درجة تلون الجلد باللون الأصفر.

نخلص من ذلك انه كلما ذادت كمية الدهون غير المشبعة في العليقه يجب زيادة المضاف من مضافات التأكسد ألي هذه العليقه.

ويعتبر كثير من الباحثين أن السيلينيوم المسمى فى هذه الحالة العامل الثالث **FACTOR III** يعتبر من مضادات التأكسد ؛حيث وجد أن نقصه يؤدى ألي إعراض مشابهة لتلك الناتجة عن وجود البيروكسيدات ونقص فيتامين ( E ) وعند إضافة السيلينيوم للعليقة أدى إلى اختفاء تلك الأعراض مثله في ذلك مثل بقية مضادات التأكسد ومن ناحية أخرى فقد وجد أن بعض مضادات التأكسد و بالتحديد **DPPD ) )** لها بعض السمية حيث أنها أدت إلى زيادة نسبة الوفيات فى الفيران و لكنها فى الدواجن يمكن يقال أنها غير سامه نسبيا؛ ومع ذلك فأن هيئة الغذاء والادويه الامريكيه تحرم استعمال هذه المادة.

ولكن كلا من **BHT & BHA** من المواد المانعة للتأكسد التي لها تاريخ طويل فى الاستعمال ؛اثبت من خلاله امانها التام ولذلك فهي تضاف بصفة روتينية ألي جميع الدهون و الزيوت للمحافظة عليها من التأكسد و من المواد المضادة للتأكسد أيضا مادة **ETHOXYQUIN** وهى تستعمل لحفظ الكاروتين فى مسحوق أوراق البرسيم (الالفاالفا ).

ويعتبر المحتوى الطبيعي من فيتامين ( E ) مادة طبيعية مانعة للتأكسد فى دهون الأعلاف الغنية فيها مثل البذور الزيتية وكذلك المواد المحتوية على الليبيدات الفوسفورية مثل الخضراوات والمواد المحتوية على الليسيثين مثل فول الصويا والخميرة وأنسجة الحيوان.

وتعتبر مادة **GUM GUAIAC** مادة مانعة للتأكسد ولذلك فهي تضاف ألي الشحوم والدهون الحيوانية والأطعمة الدهنية كما انه قد وجد أيضا أن خلط مضادات التأكسد يعطى أثرا افضل من اثر كل منها منفردا

**مضادات التأكسد الشائعة ( من غير فيتامين E ):**

**1- BUTYLATED HYDROXYTOLUENES (BHT)**

**2- BUTYLATED HYDROXYANISOLE (BHA)**

**3– DIPHENYL - PARAPHENYLELEDIAMINE (DPPD)**

وتنتجها شركة (ايستمان كوداك )وتضاف بمعدل 0.01% من المادة الفعالة في العليقة.

**4-SANTOQUIN**

وتنتجه شركة (مونسانتو )و تضاف بنفس المعدل السابق

**5-ETHOXYQUIN و يضاف 0.0125%**

**ويضاف للدهون بنسبة 0.01%**

**6- GALLATE (PROPYL; OCTYLADODECYL)**

**مميزات مضادات الأكسدة الطبيعية:**

1- متوفرة في الغذاء.

2- لا تؤثر على لون و طعم المنتج النهائي.

3- لا ينتج عنها أمراض إلا في حالة زيادتها زيادة غير طبيعية ينشأ عنها حالات تسمم كما فى حالة (التسمم بالسيلينيوم).

**عيوب استخدام مضادات الأكسدة الصناعية:**

**1- التأثير السام ( toxicity ):** وجد أن بعض المركبات الصناعية المضادة للأكسدة تحدث أثرا ساما إذا زاد تركيزها عن الحد المسموح به. مثال لذلك إضافة مادة **dodecyl gallate.** بتركيز 65 **جرام** /كجم دهن يؤدى لحدوث تسمم غذائي.

2- **التغير فى اللون discoloration:** وجد أن بعض مضادات الأكسدة الصناعية تتحد مع المعادن الموجودة فى وسط الدهون وتؤدى لحدوث تغيرات فى اللون و مثال لذلك إضافة (PG) يؤدى لظهور لون أزرق غامق لاتحاده مع عنصر الحديد . اما مركبات **BHT & BHA** فإنها تتحدمع الحديد لتعطى لون بنفسجي.

**الشروط الواجب توافرها بمضادات الاكسدة:**

**1-** أن تكون عديمة اللون و الرائحة.

2- أن تضاف إلى الدهون بالتركيزات غير السامة و الضارة بالصحة.

3- أن تكون خالية من المواد السامة مثل الزرنيخ و الرصاص و النحاس.

4- لا تسبب إي تغير في لون أو طعم أو رائحة الغذاء المضاف إليه.

5- أن تمتزج تماما بالزيوت أثناء عملية التصنيع ولا تنفصل عنها بالتخزين.

6- يفضل أن تكون رخيصة الثمن لعدم اضافة أعباء اقتصادية على الغذاء.

7- أن يكون من السهل الكشف عنه وتقدير كميتة فى الغذاء.

**تأثير مضادات الاكسدة على بدارى التسمين:**

1- زيادة معدل النمو.

2- تحسين الكفاءة التحويلية للغذاء.

3- زيادة ترسيب الصبغات بالجلد والأرجل.

4- زيادة تركيز الكاروتين فى الدهن والدم والكبد.

5- إطالة مدة حفظ الذبيحة عن طريق حماية دهنها من الأكسدة.

6- عدم ظهور أعراض نقص الفيتامينات الذائبة فى الدهون نتيجة حفظها من التلف.

**ثانيا: تأثير إضافة مضادات الأكسدة على الدجاج البياض:**

**1- ا**رتفاع نسبتي الخصوبة و الفقس.

2- تزداد درجة لون صفار البيض الناتج نتيجة لحماية مادة الزانثوفيل فى الغذاء.

**SOME REVIEWS**

**Effect of dietary oil and fat levels on live body weight :**

 Sayed, (1999), reported that the best level of oil/fat sources were 4% for sunflower oil, 4% for poultry fat, 2% for animal tallow and 4% for bone fat, either during the growing (1-4 weeks), finishing (5-7 weeks) or allover the experimental period (1-7 weeks) of age.

 In Japanese quail Christaki, et al., (1994) , reported that there is not singificant effect on live body weight at 42 days of birds age which were fed diets containing (sunflower seed meal, “SSM” crude protein 300 gm/kg and crude fiber 230 gm/kg ) at levels of 0, 35,50, and 65 gm/kg.

 Sun and Shim, (1994) reported that incorporation of fish oil, lard or sunflower oil at level of 4% of female Japanese quail diets had no significant effects on growth performance compared to the control diet during the first 4 or 7 weeks of age.

 Samy, (1995) reported that the statistical analysis at the end of growing period of Japanese quail ( 6th weeks of age ) revealed no significant differences was found between control group and group fed on poultry fat supplemented diet.

 Abd El-Latif , (1997) reported that the final body weight of Japanese quail fed on diet containing (quail manure, 17% CP and 1773 Kcal.ME/kg) and 3% vegetable oil was significantly (P<0.01) lower by using 15% manure in the diet compared to the other treatemnts.

 Badawy, (1997) found that the supplementation of diet with sunflower oil at levels of 5 or 10% and palm oil at levels of 5 or 10 % from 1 day old to 8 weeks of age did not improved growth rate or body weight of Japanese quail.

**Effect of dietary oil and fat levels on body weight gain:**

 El-Sherif, *et al.,* (1995) reported that broiler chickes fed on diets containing 15% sunflower meal gained significantly less than those fed other levels of 5 and 10% and control diet.

 Sayed, (1999) reported that the chicks fed sunflower oil supplemented diets at 4% level showed superior body weight gain values than those receiving other oil/fat sources and surpassed also the control.

 In Japanese quail Mohan, *et al*., (1990) reported that the body weight gain of Japanese quail had recorded averages of 135.0, 126.7, 102.4,135.1 and 131.4 g for control group and groups fed on diets with ground nut oil meal, seasame oil meal, soybean oil, and sunflower oil meal, from hatch to 6 weeks of age.

 Christaki, *et al.,* (1994) found that there is no significant effect of sunflower seed meal (SSM) supplementation at levels of 0.35,50 and 65 gm/kg on body weight gain of Japanese quail.

Abd El-Latif, (1997) reported that a greater (P<0.01) body weight gain was observed during the period from 0 to 6 weeks in basal diet with 3% vegetable oil and without quail manure compared with 15% manure diet with 3% vegetable oil of Japanese quail.

 Badawy, (1997) found that supplementation of growing Japanese quail diets with sunflower oil at levels of 5 or 10% and palm oil at levels of 5 or 10% from 1 day old to 8 weeks of age had no significant effects on daily body gain except at periods 21-28 and 28-35 days of age in which the two levels of plam oil show significantly lower growth than the other treatments.

**Effect of dietary oil and fat levels on feed intake:**

 El Sherif, *et al.,* (1995) reported that the feed intake of broiler chicks (19-45 days ) significantly reduced by using 15% sunflower oil meal compard with 10% sunflower oil meal or control group.

 Roth Mair and Kirchgessner, (1995) found that the sunflower seed as a source of fat improved feed intake and feed efficiency of broiler.

 In Japanese quail, Mohan, *et al.,* (1990) reported that the feed intake of Japanise quail from 1 day old to 6 weeks of age had recorded 557.9 , 485.5, 410 5, 547.3 and 664.1 g for control group and groups fed diets supplemented with ground nut oil meal, sesame oil meal, soybean oil meal and sunflower oil meal, respectively.

 Christaki *et al*., (1994) reported that there is no significant effect on feed intake at 42 days of age of Japanese quail which fed on diets containing (sunflower seed meal “SSM” crude protein 300 g.kg and crude fiber 230 g/kg) at levels of 0, 35, 50 and 65 g/kg diet.

 Samy, (1995) reported that the feed consumption and feed conversion of Japansese quail were different by about 3.7 and 6.9% than the control group and poultry fat group (4.5%).

 Abd El-Latif, (1997) found that the amount of feed intake increased with increasing the level of manure in the basal diet with constant level of 3% vegetable oil with all treatments during the entire experimental period.

**Effect of dietary oil and fat levels on feed efficiency** :

 El- Serwy, *et al.,* (1992) found that the feed conversion of broilers fed high and medium starter energy diets (3409 Kcal / kg and 3205 Kcal ME/kg) with 9.35 % and 5% oil was significantaly superier compared to feed conversion of birds fed low energy starter diets (3003 Kcal/ME / Kg) with 2.75% oil.

 El Sherif, *et al.,* (1995) reportd that no significant differences of feed conversions were found between the control group and the group fed 15% sunflower meal. Also, no significant differences were observed between the two groups fed 10 or 15% sunflower meal in feed conversion by broilers.

 Sayed, (1999) found that the chicks fed sunflower oil supplemented diets at 4% levels show superior feed conversion efficiency values than those receiving other oil/fat sources.

 In Japanse quail,Mohan, *et al.,* (1990) found that the feed efficiency ratio receorded 4.13, 3.85, 4.01, 4.05 and 5.05 (Feed:gain ) respectively for Japanese quail fed on starter diets to 3 weeks old and grower diet from 3 to 6 weeks old of the control, ground nut oil meal, sesame oil meal, soybean oil meal and sunflower oil meal group respectively from 0 to 6 weeks old.

 Christaki, *et al.,* (1994) reported that the level of sunflower seed meal at levels of 0, 35, 50 and 65 g/kg, had no significant effected on feed conversion of Japanese quail.

 Samy, (1995) reported that the feed conversion of Japanese quail from 1 day old to 6 weeks of age were 3.33, 3.44 , 3.36 and 3.56 for groups fed on control , sorghum, cassave and Poultry fat supplemented diets respectively. Recordes of feed conversion showed that the best records was obtained by control, cassava, sorghum and poultry fat supplemented diets, respectively.

 Abd El-Latif, (1997) found that the feed efficiency of Japanese quail at 6 weeks old fed on diet supplied with quail manure at levels of 5, 10 and 15% with constant vegetable oil at 3% with all treatments was diminshed with increasing manure levels in the diet. A highly (P<0.01) reduction in feed efficiency (gain/feed) was not noticed in 15% manure level compared with other treatments.

 Badawy, (1997) recognized that the addition of sunflower oil or palm oil at high levels significantly improved the feed conversion especially in the second phase of growing period from 28-42days of Japanese quail age.

**Effect of dietary oil and fat levels on carcass charcteristic:**

 Sayed, (1999) reported that there is no significant differences in the percentage of either dressing weight, giblets or total edible parts due to treatments diets which supplied with vegetable oil (plamoil, sunflower oil and palm kernel oil the later contains 50% by weight oil) or animal fat sources (animal tallow, bone fat and poultry fat). However, the effect was more pronounced in the proportional weight of abdominal fat as a results of feeding chicks on different dietary oil fat sources.

 In Japanes quail Christaki *et al*., (1994) reported that carcass weight, carcass yield and liver, heart and gizzard weight were not affected by diet while there were differences (P<0.01) in carcass fat and ash content, but not in carcass water and protein content . The diets content (sunflower seed meal “SSM” crude protein 300 g/kg and crude fiber 230 g/kg) at levels of 0, 35, 50 and 65 g/kg diet.

 Samy, (1995) found that the records of total edible parts percentage, regardless of energy levels and sex were found to be 73.08 , 71.54 , 71.15 and 68.16% for groups fed on cassava, control ration, poultry fat and sorghum supplemented diet, respectively. There were a significant differences among sorghum supplemented diet and other experimental groups.

 Abd El-Latif, (1997) reported that the effect of feeding different levels of quail manure (5, 10, and 15%) with 3% vegetable oil for all treatments on carcass composition (weights of carcass, intestine and offal and its proportion to live body weight). There were no significant differences between all treatments in dressing percentage, intestine weight % and offal weight %. In general, there was a slight depression in dressing percentage with increasing manure level in the diets.

 Badawy, (1997) reported that the supplementing of Japanes quail growing ration with either sunflower or palm oil at high (10%) or low (5%) reduced dressing , percentage of quail with at least 3.7% , the lowest value was observed in group fed diet supplemented with the high level of sunflower oil (59.0%) compared with the control diet (66.0%) the differences among treatments were not statisitically significant. On the other hand, significant effects of treatments in giblets percentage and breast circumference were detecteed in group fed diet supplemented with 5% sunflower oil showed highest performance.

**Effect of dietary oil and fat levels on nutrients digestibility:**

 Mateos and Sell (1981a &b); Mateos, *et al.,* (1982) observed that diets with added fat decreased the rate of passage thereby permitting better digestion and absorption.

 AbdEl-Samei, (1983) observed that the digestability coefficient either of crude protein , crude fiber, nitrogen free extract ether extract or organic matter were reduced by increasing the level of dietary oil , fat from 2.5 to 7.5% thereby the higher ether extract digestibility coefficients reported in soybean oil supplementation treatments was due to the more absorbed unsaturated fatty acid present in the soybeen oil than other sources in laying hen.

 El-Helaly, (1983) indicated that increasing the level of supplemental fat to broiler chicks tended to increase the digestibility coefficient.

 Golian and Polin, (1984) found that the transit time of diets for chicks up to 21 days of age was not affected by adding vegetable oil up to 10% of the diet.

 Klaus, *et al.,* (1995) demonstrated that the sources of fat supplementation affected body weight of broiler and suggest that saturated fats are less digestible in young chicks.

 Sayed, (1999) reported that the mean values of absorbability rate of different oil/fat sources were 71.79, 85.38 , 69.27, 73.33, 76.62 and 73.80 for palm oil (PO) , sunflwer oil (SFO), palm kernel oil (PKO) , Bone fat (BF), , animal tallow (AT) and poultry fat (PF),respectively, using broiler chicks.

**Effect of dietary oil and fat levels on feed costs efficiency :**

 Elias, *et al.,* (1986) reported that the feeding costs assessed per quail and per kg live weight and according to time of year.

**Effect of dietary oil and fat levels on blood constituents.**

 Younis, (1981) showed that the addition of both corn oil or animal fat to rations of growing white plymoth Rock increased there cholesterol and total lipids levels in blood plasma compared with groups reciving no add fat or oil in these diets and the increase was more pronounced when animal fat were added. He showed also that there was a highly significant positive correlation found between blood cholerterol and blood total lipids.

 Abd El- Ghani, (1986) reported that addition of margarin to Hubbard boiler chicks rations significantly increased cholesteral in blood serum followed by tallow in comparison with cotton seed oil at 8 weeks of age. He added that the serum cholesterol has been increased with the increases of the lipids levels in the diets.

 Abou El-Wafa (1988) reported that the sunflower oil (SFO) cuased a marked decrease in the total lipids and total cholestrol content of blood for broiler.

 Abd El-Magied, (1988) found that the serum total lipids ( Mg/100 ml / serum ) increased significantly by supplementing the broiler rations with a fat at 4 and 8 weeks of age. Also serum cholesterol (mg/100ml /serum) increased significantly at 4 and 8 weeks of age with fat supplementation.

 Sayed, (1999) reported that the regarding the total lipids and total cholesterol of blood, sunflower oil was the best one and gave approximately similar values to that obtained by the control group. Moreover, poultry fat and bone fat were superior than animal fallow, but still comes after sunflower oil.

 In Japanes quail Poyraz, (1991) found that plasma cholesterel was 121.2 , 144.2 and 86.0 (mg/100 ml / serum ) in female quails and their hybrids.

 Hood, (1991) reported that the serum triglyceride concentration were lower in the quail fed two diets (linseed and tuna oil ) containing n-3 fatty acids in comparison with beef and safflower treatment groups.

 Sun and Shim, (1994) found that the total plasma cholesterol values after 4 and 7 weeks were higher than at the starter of experiment for female Japanese quail which fed for 4 to 7 weeks on basal diets containing 4% fish oil, lard or sunflower oil.

 David, *et al.,* (1996) reported that the serum cholesterol concentrations in female bob white quail with sexually distinct (D) and indistinct (I) external phenotypes at 56 days of age were 155.8 and 141. 4 ( Mg/100 ml/ serum) respectively.

 Badawy, (1997) found that the highest concentration of cholesterol and triglycerides were obtained in the treatment of high level of palm oil 10% while the lowest concentrations were found in the low level of sunflower treatment 5% by using Japanese quail. The investegator recognized that the supplementation of ration with 5% sunflower oil resulted in a reduction of cholesterol and triglycerids concentration in blood with about 30% to 40% compared to the values of the control. He added that increasing the supplementation level of sunflower oil to 10% resulted in a significant increase in the cholesterol and triglycerides levels.

 **REFERENCES**

Abd El-Ghani I.A. (1986): Studies on meat production in poultry. Ph.D. Thesis, Fac. Agric., Cairo University.

Abd El-Magied, A.H. (1988): Effect of different fat levels in broiler rations on age at marketing and carcass composition. M.Sc. Thesis, Fac. Agric., Al-Azhar University.

Abd El-Latif, S.A. (1997): Using dried quail manure in diets for growing Japanese quail. Egypt. Poult. Sci. 17: (II) (115-125). Abd El-Samei, A.H. (1983):Effect of dietary oil/fat sources and levels on production performance of laying hen.M.Sc. Thesis, Fac. Agric., Cairo University .

Abou El- Wafa S. (1988):Effect of Dietary Nutrients levels on broiler performanceM.Sc. Thesis, fac. Agric., Cairo University .

Badawy, N.A. (1997): Influence of dietary oils on performance, blood lipid and immuno-response of Japanese quail. Egypt. Poult. Sci., 17:11 (53-75).70

Christaki, E.V.; P. Florov-Paneri; A.L. Tserveni Gousi and A.V. Spais (1994):

Effect of sunflower seed meal on performance and carcas characteristics of growing Japanese quail.Animal Feed Science and Technology , 48: 169-174.

David, E.P.; J.D. Cheaney; K.U. Vauchn; M.A. Latour; T.W. Smith; R.L. Haynes and

 C.R. Boyle (1996): Changes in gonadal weight serum lipids and glucose during maturation in the Juvenile northern bobwhite quail (Colinus virginianus).Poult. Sci., 75: 411-1416

**El-Helaly, N.A.H. (1983**):The effect of various dietary fat sources and levels on the performacne of broiler chicks.M.Sc. Thesis, Fac. Agric., Cairo University .Elias, V.L. ; J.C. Maneut and I.J.

**Verde (1986**):Comparative study of different rations in the fattining of quail -2- Effect of the inclusion of home - Produce ingredients of feeding costs of Japanese quail. Nutration ABs review

**Sept. (1986**) Effect of adding different levels of expeller sunflower seed meal in broiler diet.

First Egyptian Hungarian Poultry Conference, 17-19 Sept. 1995 Alexandria, Egypt. 46-51.

**Hood- R. L. (1991):**Research not; Effect of dietary fats on hepatic cholesterol synthesis in Japanese quail.Poultry Sci., 70: 1848-1850.

**Klaus, A.M.; H. Fukrmann and H.P. Sallmon (1995):**Peroxidative and antioxidative metabolism of the broiler chickens as influenced by dietary linoleic acid and vitamin E. Arch. Geflucgelle 59: 135-144.

**Mateos, G.G. and J.L. Sell (1981** B):Influence of fat and carbohydrate sources on rate of food passage of semi purified diets for laying hens.

 Poultry Sci., 60: 2112-2119.

Mohan, B.; P.R. Reddy; D. Narahari and A. Thango(1990): Effect of feeding different vegetable protein on the val performance of Japanese quail. Indian Journal of Poult. Sci., 25: 178-182

Roth- Maier , D.A. and M. Kirchgessner (1995): Feeding of full - fat flax seed and sunflower seed to fattining chickens.Arch Geflvegelk, 59: 319-322.

Poyraz’O (1991): Study of plasma, glucose, cholesterol and protein values in chickens, quail and their hybrieds.Poultry Abs, 17 : - 824.

Samy, M. (1995):Effect of energy source and level on performance of production and reproduction of Japanese quail.M.Sc. Thesis, Anim. Prod. Dept., Fac. of Agric., Al-Azhar University .

Sayed, M. A. M. (1999):The use of some vegetable oil and Animal fat sources for feeding broilers.Ph.D. Thesis, Faculty of Agriculture, Cairo University.

Sun, A.Q. and K.F. Shim (1994):Effect of dietary lipids supplement on cholesterol level in Japanese quail (Coturnix coturnkx Japonica).Singapore, J. of Primary Industries 22: 12-24.

Younis, T.M. (1981):Effect of source and level of fats on growth and fertility traits of some poultry breeds.M.Sc. Thesis , Fac. Agric., Al Azhar University .