LIPID TRANSFER IN CHICKEN OVARY

BY

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THESIS

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DECLARATION

I hereby declare that this thesis entitled "LIPID TRANSFER IN CHICKEN OVARY" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Mannuthy,
31.7.1981

MATHEW THOMAS

CERTIFICATE

Certified that this thesis entitled "LIPID TRANSFER IN CHICKEN OVARY" is a record of research work done independently by Sri. Mathew Thomas under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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MATHEW THOMAS

DEDICATED TO MY BELOVED PARENTS

C O N T E N T S

INTRODUCTION

INTRODUCTION

The reproductive physiology of domestic chicken (Gallus-domesticus) and to a lesser extent that of domestic turkey (Meleagrius-Gallopavo) has been the subject of intensive research for the last few decades. But still there was many mechanisms,-metabolic, endocrine-which require further elucidation. The formation of an avian egg depends on the transport of materials across the membranes in the body. It involves the synthesis and incorporation of specialised substances. The formation of an egg in the avian ovary and oviduct involves numerous steps which take place in definite sequence of time and space. The egg, as it is laid, is made up of nutrients both in the yolk and albumen and has in its constitution water, several protective membranes and a hard shell.

Egg formation in the domestic hen involves not only the ovary and oviduct but it depends also on the activities of various other organs. An egg which weighs approximately 58 g contains about 7 g protein, 6 g fats, 2.5 g minerals, 3 g non metallic elements and about 39 g water. Of the different components of egg, egg yolk is the first thing to form. This takes about 7 to 8 days. The whole of the rest of the egg is added within a period of 24 hours (Bell and Freeman, 1971).

It may be noticed from the composition of an egg that the fat in egg yolk forms a major portion of the avian egg. The yolk substances are actually produced in the liver. Before they are deposited in the oocyte, they have to be transported by the blood to regions in the ovary adjacent to vitelline membrane.

The mechanisms involved in the passage of yolk substances across the follicular wall and its deposition in the oocyte are not well understood. It has long been known that changes taking place in the blood plasma and liver of domestic fowl when egg production begins can be stimulated by the administration of oestrogenic substances to the immature birds (Lorenz, 1954).

Since the exact mechanisms involved on the role played by the hepatic tissue on fat production, the transport of lipids by the blood, and their transfer to the ovary are not quiet well understood, it was throught worthwhile to study the interrelationship existing between all these parameters in White Leghorn breed of fowls. An attempt is also made to study the effects of different combinations of female sex hormones on the fat metabolism in White Leghorn pullets. This study is likely to throw more light on the physiology of lipid transfer to the ovaries in birds.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The lipids from the liver are transported through blood to the ovary and deposited in the egg. In avian as well as in mammalian species fatty acids are synthesised in the cytoplasm of cells in the liver, mammary gland, heart, lung and brain from acetyl coA. The biosynthesis of long chain fatty acids is under nutritional, hormonal and metabolic influences. The hepatic phospholipid concentration has been found to increase as the age of the bird increased (Thayer et al., 1973). Many more factors may be involved in the accumulation of fat in liver, including genetic predisposition, dietary nutrient quality, level of oestrogens and management (Harms et al., 1977).

The influence of age on cholesterol ester level in liver tissue has been investigated by Heldman and Granthman (1964). They have shown that there was increased synthesis of cholesterol as the age of the bird advanced. The adrenals have also been implicated in the regulation of hepatic lipogenesis (Entenmann et al., 1940). Most of the cholesterol found in the egg was synthesised in the liver of a bird (Naber, 1976). Lorenz and Chaikoff (1940) could notice different correlations at significant levels existing in between ovarianand hepatic total cholesterol content in the same age groups of birds. Cholesterol and fatty acid syntheses were found to be very active in the hepatic tissue of chick (Goodridge, 1968b).

The carbon atom from glucose is incorporated into fatty acids and cholesterol at a low level in the embryonic chick liver. However, it increased rapidly on hatching and feeding (Goodridge, 1968b).

The liver of the laying hens contains more than double the amount of lipids than that found in immature birds (Bell and Freeman, 1971). These lipids are almost entirely made up of triglycerids. Triglycerids are the most significant group of lipids from the stand point of energy need. They may be provided by the diet or may be synthesised from non lipid sources. The hepatic triglycerids concentration in laying hens has been found to be about three times that seen in cocks (Husbands and Brown, 1965). Total lipid accumulation upto a level of 45 to 50% on dry matter basis of the liver was shown to meet the requirement of total lipids for egg production in hens. The implication that the liver was involved in the production of yolk precursors has been established by Hevesy and Hahn (1938). More recently, direct evidence on the syntheses of yolk proteins by the hepatic tissue has begun to accumulate. This applies, to a major extent, to the syntheses of phosphovitellin which is present in the hepatic tissue of laying birds and oestrogenised cockerels (Greenguard et al., 1965).

Egg formation in the ovary is dependent on the lipids synthesised in the liver and transported as lipoproteins to the ovary (Badman, 1961). As the bird advanced in age there occurred a progressive increase in hepatic lipogenesis (Entermann et al., 1940). McIndoe (1959) presented evidence in support of the above finding and found that increased content of total lipids in liver was quiet evident in laying hens. The total lipid content of the liver and the rate of egg production were shown to be directly correlated (Speers and Balloun, 1966). It has also been noted that the liver lipid content varied with the stage of laying, and period of laying (Wolford and Polin, 1972, Nesheim et al., 1969). Goodridge (1960) has provided conclusive evidence to show that higher liver lipid content in laying birds was due to increased lipogenesis in the liver.

Significant direct correlation existed between total liver lipid content and the rate of egg production (Speers and Balloun, 1966). Further, the size of the liver was directly related to the body size of the hen. This particular relationship was thought to be a limiting factor in the rate of egg production by laying birds (Shivaprasad and Jaap, 1977). The increase in liver weight coincided with the increase in liver lipid concentration. It has been found that varying degrees of higher lipid content above that found

in the poor layers were required to regulate egg production in line with the genetic potential of the birds (Garlich et al., 1975).

Sturkie (1956) stated that secretion of oestrogen in birds increased the content of low density lipoproteins, mostly made up of phospholipids, which are deposited in the ovary as the bird matured. Low density lipoprotein containing almost 90% lipid has been isolated by Martin et al.(1959) and was shown to account for about 95% of yolk lipids. Low density lipoproteins are heterogenous and two components have been separated, protein (11%) and neutral lipids (66%) and phospholipids (23%). Cholesterol accounted for 4% of the lipid fraction (Martin et al., 1963).

Marion and Sell (1963) have noticed accumulation of solids including cholesterol during maturation of avian ovary. However, the total quantity of cholesterol deposited in each egg was more or less constant (Spencers et al., 1971). Evidences have been presented to show that cholesterol is being transmitted to and deposited in the ovary and that there was no actual syntheses of cholesterol in the avian ovary.

Hafez and Kamar (1955) noticed increased weight of ovaries as the bird matured which was attributed to the accumulation of lipids in the ovary. During the post embryonic development of ooeyte there is a period of slow growth during which time

deposition of yolk consisting mainly of neutral fats occurs.

Boundary electrophoresis of blood plasma revealed the presence of large amounts of proteins in laying hens and oestrogenised cocks compared to that found in immature fowls and untreated cockerels (Moore, 1948). Eventhough evidences were presented for the presence of low density lipoproteins and lipovitellin in the blood plasma of laying hens, strict proof of their presence has not yet been furnished (Bell and Freeman, 1971). Sehjeide and Urist (1956), Sehjeide et al. (1963) and Sehjeide and Wilkens (1964) showed that there was a great increase in the level of low density lipoprotein and decrease in the high density components in the plasma when the birds attain sexual maturity. Cook (1968) found that avian egg yolk contained lipoproteins similar to that in plasma.

Furr (1970) noticed cholesterol in high concentration in the blood of chicken. This actually confirmed the reports that high concentration of cholesterol was associated with egg yolk formation (Sturkie, 1965). However, Spencer et al. (1977) could notice no appreciable fluctuations in serum cholesterol levels in female birds with increase in age.

A mild hyperlipemia could be noticed in the blood serum of layers at the onset of laying which returns subsequently to

normolipemic level as egg production progress (Simon Cho, 1981). It has been stated that the plasma lipid concentration become increasingly important in the egg yolk formation as the bird attained sexual maturity (Naber, 1976). Heald and Badman (1963) indicated that change in plasma lipid concentration was greatest at day 14 preceeding oviposition. They further observed that at the onset of laying a sharp fall in the plasma lipid level occurred.

The effects of administration of exogenous sex hormones on the development and function of avian reproductive system have been under investigation for the last few decades (Herts et al., 1947, Brant and Malbandov, 1956, Mohsin and Pal, 1975, Pillai and Nirmalan, 1979). Combs et al. (1958) noticed significant increase in the body size and weight in diethylstilbesterol treated birds.

Taurong et al. (1944) have shown that oestrogen administration resulted in increased hepatic phospholipid concentration. Endogenous oestrogens secreted during the time of maturity increased fat content of liver and phospholipid mobilisation in the liver of birds. Further, Sturkie (1956) stated that oestrogen secretion in birds resulted in increased concentration of low density lipeproteins mostly phospholipid in ovaries of the birds as they attainedm maturity. Entenmann et al. (1944) have shown that administration of stilbesterol

resulted in significant increase in the phospholipid content of the liver tissue in birds. Similarly, Nalbandov (1953) presented evidences to show that oestrogenisation of cockerels resulted in increased content of hepatic phospholipids.

Cholesterol content of the hepatic tissue was seen increased after administration of oestrogens to cockerels (Bell and Freeman, 1971). Cholesterol and fatty acids syntheses were occuring at a high level. Administration of sex hormones increased incorporation of carbon atoms of glucose into fatty acids and cholesterol, which occurred at a very low rate during embryonic stage of development (Goodridge, 1968b). Entenmann et al. (1940) noticed the occurence of high concentration of cholesterol in the ovarian tissue for which the reason attributed was secretion of sex hormones as the birds grew older. Common et al. (1946) reported the synergistic effects of oestrogens, Androgens and progesterone on the high concentrations of serum lipids including serum cholesterol.

Hood et al. (1950) noted the effect of diethylstilbesterol administration in birds which resulted in significantly higher fat deposition in the liver of birds. Combs et al. (1958) found increased body weight in turkeys receiving diethylstilbesterol pellets subcutaneously which resulted in higher feed consumption per unit weight gain and the resulting fat deposition in the

body. Further he reported that diethylstilbesterol treatment resulted in increased liver weight lipid accumulation in the liver and abdominal fat deposition in pullets. Stamler et al. (1950) have found that oestrogen influenced lipid metabolism by increasing syntheses of lipids along with decreased dissipation from the liver.

High lipid content in the avian blood was reported to be normal during egg laying as well as after administration of exogenous sex hormones (Fleischehemm and Fried, 1945, McDonald et al., 1945, Heald and Rookledge, 1964). Tienmoren (1958) noticed that when hens were administered oestrogens (300 mg/bird) they showed lower ovarian activity and egg production. Nalbandov (1953) presented evidences to show high plasma lipid concentration as a result of administration of sex steroids. Pillai and Nirmalan (1979) could notice no appreciable change in size and weigh of ovaries in immature birds treated with stilbesteroldipropionate. Cook et al. (1957) noticed an inhibitory effect of testosterone on the plasma cholesterol level in birds.

MATERIALS AND METHODS

MATERIALS AND METHODS

Ten numbers each of clinically healthy White Leghorn female birds of five different age groups were selected at random from the Kerala Agricultural University Poultry Farm. The birds belonged to the following age groups of 50-54-days, 70-74-days, 100-104-days, 129-133-days and 223-227-days (laying). Each group of birds was housed separately in cages and maintained under standard farm conditions. The composition of the grower mash fed to the birds is given in table No.2.1 and that of the layer mash in table No. 2.2.

The selected birds were reared for five days. At the end of this period all the birds except those belonging to 100-104-days age groups were slaughtered by de-capitation. The blood was collected in clean dry test tubes and stoppered. It was then kept in the freezer compartment of a refrigerator in a slanting position over night, for blood serum to get separated. The serum was siphoned off in to a clean dry test tube and was used for different chemical analyses. The carcase of the bird was then cut open and the viscera was removed mechanically. Liver and ovary were dissected out completely and gently pressed between the folds of a filter paper to remove the adhering fluids and stored in a freezer compartment of a refrigerator. The entire liver tissue was cut and macerated in a Potter-

Elvehjem tissue homogeniser and a small portion of it was weighed. A weighed quantity of ovary was also taken from each bird in the same way as described above for liver tissue. Tissue homogenates were prepared by adopting the method of Colowick and Kaplan (1963). Total lipid content in the liver and ovary were estimated by the method of Maynard and Joslyn (1970) and that in the serum was estimated by extraction with ether and a subsequent extraction with methyl alcohol after absorbing five ml of serum into a piece of cotton, in a soxhlet apparatus. Phospholipid content was estimated by using the method of King and Wootten (1959). Total cholesterol content in the liver, serum and ovary was estimated by the method of Zak (1957).

The effect of administration of exogenous sex hormones on pullets was studied in 100-104-days-old White Leghorn pullets. Forty numbers of 100-104-days-old birds were randomly selected to form four different groups, each group containing ten birds. The birds were weighed before the start of the experiment. The body weights of the birds are given in Table 2.3.

The first group of ten experimental birds (100-104-days-old) received 1 mg of diethylstilbestrol (DS) in 0.25 ml of olive oil intramuscularly in the pectoral muscles daily for

Table No. 2.1 Composition of grower mash

Ingredients	Percentage
Ground nut cake	18
Yellow maize	10
Wheat	10
Dried tapioca chips	15
Wheat bran	15
Rice bran	20
Un salted dried fish	10
Mineral mixture (Poultry)	1.5
Common salt	0.5
Total	100.00

"Neftin" was added at the rate of 25 g per ton of mixed feed

Table No. 2.2. Composition of Layer mash

Ingredients	Percentage
Ground nut cake	17
Yellow maize	10
Wheat	11
Tapioca chips	15
Wheat bran	15
Rice bran	20
Unsalted dried fish	10
Mineral mixture	1.5
Common salt	0.5
Total :	100.00

"Bifuran" 50 g, Revimix 25 g and Neftin 25 g were added to a ton of mixed feed.

Table 2.3 Body weights of birds of the different experimental group before the starting of the experiment.

No. of birds	Control	Birds intended for estrogen treatment	Birds intended for estrogen and progesterone treatment	Birds intended for estrogen, progesterone and testosterone treatment.
	g/bird	g/bird	g/bird	g/bird
1	850	853	863	860
2	850	872	872	862
3	863	874	870	854
4	868	863	859	858
5	854	852	855	858
6	850	875	874	869
7	857	848	866	869
8	870	855	871	858
9	875	853	856	854
10	843	854	858	857
Mean value	856	857	860	859

ten days. Second group of ten experimental birds (100-104-days-old) received a daily dose of 1 mg diethylstilbestrol (DS) and 1 mg of progesterone (PG) each in 0.25 ml of olive oil intramuscularly for ten days in the same region. The third group consisted of ten White Leghorn pullets which received an intramuscular injection of 1 mg of diethylstilbestrol (DS) 1 mg of progesterone (PG) and 1 mg of testosterone dipropionate (TD) each in 0.25 ml of olive oil daily for ten days. The control group of ten birds received a daily dose of 0.25 ml of olive oil intramuscularly for ten days. The treatment was discontinued for one day. All the birds were sacrificed on the twelfth day.

The blood, ovary and liver were collected as described earlier. Total lipids, phospholipids and total cholesterol were estimated in ovary, liver and serum as described above.

The data were statistically analysed by using Randomised Block Design (Snedecor and Cochran, 1967). Pair wise comparison with student's 't' test were used for finding out the significance (P 0.01) between age groups and also between treatments.

RESULTS

RESULTS

The phospholipid content in the ovarian tissues of White Leghorn birds of different age groups are given in Table 4.1.

Table 4.1 Phospholipids in the ovaries of White Leghorn birds of different age groups (Values are mean ± S.E)

Sl.No.	No. of birds	Age in days	Phospholipids (mg/g)
1	10	50-54	9.90 ± 0.39
2	10	70-74	14.23 ± 0.44
3	10	100-104	16.05 ± 0.32
4	10	129-133	15.09 ± 0.43
5	10	223-227	20.46 ± 0.26

The ovarian phospholipid concentration in the birds showed a general tendency to increase as age of the birds advanced except in 129-133 days age groups.

The analysis of variance table showed that the "F" value calculated was greater than the critical value. The statistical analysis of the data on the concentrations of ovarian phospholipids in various age groups is given in the analysis of variance table 4.2.

Table 4.2 Analysis of variance - Ovarian phospholipid concentration in different age groups of White Leghorn birds.

Source	S.S	d.f	m.s.s	F
Age	5789.53	4	1447.38	15.89**
Error	71.53	45	91.04	
Total	5861.06	49		

** Significance at 1% level.

With pair-wise comparison of means it was found that the ovarian phospholipid content of 70-74-days-old (14.23 ± 0.44 mg/g), 100-104-days-old (16.05 ± 0.32 mg/g), 129-133-days-old (15.09 ± 0.43 mg/g) and 223-227-days-old (20.46 ± 0.26 mg/g) birds were all significally ($P < 0.01$) higher than that of 50-54-days-old (9.90 ± 0.39 mg/g) birds.

However, the phospholipid content in the ovaries (20.46 ± 0.26 mg/g) in 223-227-days-old birds was alone significantly ($P < 0.01$) higher as compared to 70-74-days-old (14.23 ± 0.44 mg/g) birds, 100-104-days-old (16.05 ± 0.32 mg/g) birds and 129-133-days-old (15.09 ± 0.45 mg/g) birds. The phospholipid

content in the ovary in between the various other age groups from 70-74-days-old-birds to 129-133-days-old did not show any significant difference.

The phospholipid content in the liver of White Leghorn birds are given in table 4.3.

Table 4.3 Phospholipids in the liver of different age groups of White Leghorn birds (Values are mean ± SE).

Sl.No.	No. of birds	Age in days	Phospholipids (mg/g)
1	10	50-54	12.94 ± 0.46
2	10	70-74	15.38 ± 0.30
3	10	100-104	18.84 ± 0.56
4	10	129-133	19.61 ± 0.34
5	10	223-227	20.02 ± 0.52

It was observed that as the age of the birds increased there was a parallel increase in the liver phospholipid concentration also.

The statistical analysis of the data on the concentration of liver phospholipids in various age groups of the birds is given in the analysis of variance table 4.4.

Table 4.4 Analysis of variance - Liver phospholipids co centration in different age groups of White Leghorn birds.

Source	S.S	d.f	m.s.s	F
Age	3772.92	4	943.29	18.92**
Error	85.11	45	49.87	
Total	3858.03	49		

** Significance at 1% level.

With pair-wise comparison it was found that the liver phospholipid content of 100-104-days-old (18.84 ± 0.56 mg/g), 129-133-days-old (19.61 ± 0.34 mg/g) and 223-227-days-old (20.02 ± 0.52 mg/g) birds were all significantly ($P < 0.01$) higher than that of 50-54-days-old (129.94 ± 0.46 mg/g) birds and 70-74-days-old (15.38 ± 0.30 mg/g) birds. At the same time the liver phospholipid content of 223-227-days-old (20.02 ± 0.52 mg/g) birds was significantly ($P < 0.01$) higher than that compared to 129-133-days-old (19.61 ± 0.34 mg/g) birds.

The phospholipids in blood serum in White Leghorn birds are given in table 4.5.

Table 4.5 Phospholipids in bloods serum of different age groups of White Leghorn birds (Values are mean ± S.E)

Sl.No.	No. of birds	Age in days	Phospholipids (mg/100 ml)
1	10	50-54	236.78 ± 2.16
2	10	70-74	258.92 ± 3.30
3	10	100-104	268.77 ± 3.88
4	10	129-133	273.44 ± 3.21
5	10	223-227	251.64 ± 1.64

The serum phospholipid concentration in the birds showed a marked increase in concentration as age of the birds advanced except for the phospholipid level at 223-227-days-old-birds.

The statistical analysis of the data on the concentration of serum phospholipid in various age groups of White Leghorn birds is given in the analysis of variance table 4.6.

Significantly higher ($P < 0.01$) values for serum phospholipid could be noticed in 70-74-days-old (258.92 ± 3.30 mg/100 ml), 100-104-days-old (268.77 ± 3.88 mg/100 ml), 129-133-days-old (273.44 ± 3.21 mg/100 ml) and 223-227-days-old

Table 4.6 Analysis of variance - serum phospholipid concentration in different age groups of White Leghorn birds.

Source	S.S	d.f	m.s.s	F
Age	8458.754	4	2114.688	85.641**
Error	3826.878	45	24.866	
Total	12285.632	49		

** Significance at 1% level.

(251.64 ± 1.64 mg/100 ml) birds compared to 50-54-days-old (236.78 ± 2.16 mg/100 ml) birds. Similarly, the serum phospholipid content of 100-104-days-old (268.77 ± 3.88 mg/100 ml) 129-133-days-old (273.44 ± 3.21 mg/100 ml) and 223-227-days-old (251.64 ± 1.64 mg/100 ml) birds showed a significantly higher ($P < 0.01$) serum phospholipid content, compared to 70.74-days-old (258.92 ± 3.30 mg/100 ml) birds.

The ovarian content of total cholesterol in the White Leghorn birds are given in table 4.7.

In ovaries of the various age groups of birds showed marked increase in concentration of cholesterol as age of the birds advanced.

Table 4.7 Total cholesterol in the ovaries of different age group of White Leghorn birds (Values are mean ± SE).

Sl.No.	No. of birds	Age in days	Total cholesterol (mg/g)
1	10	50-54	2.42 ± 0.12
2	10	70-74	5.63 ± 0.59
3	10	100-104	10.14 ± 0.32
4	10	129-133	14.18 ± 0.25
5	10	223-227	16.84 ± 0.18

The statistical analysis of the data on the concentration of ovarian total cholesterol in various age groups of White Leghorn birds is given in the analysis of variance table 4.8.

Table 4.8 Analysis of variance-ovarian total cholesterol concentration in different age groups of White Leghorn birds.

Source	S.S	d.f	m.s.s	F
Age	14063.41	4	3515.85	5.66**
Error	25.48	45	520.87	
Total	14089.89	49		

** Significance at 1% level.

The ovarian total cholesterol concentration in 223-227-days-old-birds (16.84 ± 0.18 mg/g) was significantly higher ($P < 0.01$) than 100-104-days-old (10.14 ± 0.32 mg/g), and 50-54 days-old (2.42 ± 0.12 mg/g) birds.

The total cholesterol content in the ovaries of 129-133-days-old-birds (14.18 ± 0.25 mg/g) was significantly higher ($P < 0.01$) than that of 70-74-days old (5.63 ± 0.59 mg/g) birds and 50-54-days-old (2.42 ± 0.12 mg/g) birds. The 100-104-days-old-birds (10.14 ± 0.32 mg/g) and 70-74-days-old-birds (5.63 ± 0.59 mg/g) showed significantly ($P < 0.01$) higher concentration of ovarian total cholesterol as compared to their respective younger age groups of 70-74-days-old-birds and 50-54-days-old-birds (2.42 ± 0.12 mg/g).

The total cholesterol content in the liver of White Leghorn birds are given in table 4.9.

Table 4.9. Total cholesterol in the liver of White Leghorn birds of different age group (Values are mean ± SE)

Sl. No.	No. of birds	Age in days	Total cholesterol (mg/g)
1	10	50-54	4.46 ± 0.15
2	10	70-74	8.39 ± 0.34
3	10	100-104	12.95 ± 0.42
4	10	129-133	15.19 ± 0.20
5	10	223-227	17.90 ± 0.79

The total cholesterol content in the liver showed a tendency to increase in concentration as the age of the birds increased.

The statistical analysis of the data on the concentration of liver total cholesterol in various age groups is given in the analysis of variance table 4.10.

Table 4.10 Analysis of variance liver total cholesterol concentration in different age groups of White Leghorn birds.

Source	S.S	d.f	m.s.s	F
Age	11544.42	4	2886.10	9.115**
Error	41.01	45	316.22	
Total	11585.43	49		

** Significance at 1% level.

No statistically significant difference could be seen existing between the total liver cholesterol content of 50-54-days-old (4.46 ± 0.15 mg/g) and 70-74-days old (8.39 ± 0.34 mg/g) birds. However, there was significantly ($P<0.01$) higher concentration of total liver cholesterol concentrations in 100-104-days-old (12.95 ± 0.42 mg/g), 129-133-days-

old (15.19 ± 0.20 mg/g) and 223-227-days-old (17.90 ± 0.79 mg/g) birds when compared to that of 50-54-days-old (4.46 ± 0.15 mg/g) birds and 70-74-days-old (8.39 ± 0.34 mg/g) birds.

The cholesterol content in bloods serum of different age groups of White Leghorn birds are given in table 4.11.

Table 4.11 Total cholesterol in the blood serum of different age groups of White Leghorn birds (Values are mean ± S.E).

Sl.No.	No. of birds	Age in days	Total cholesterol (mg/100ml)
1	10	50-54	175.81 ± 3.52
2	10	70-74	168.40 ± 5.65
3	10	100-104	171.57 ± 1.47
4	10	129-133	179.73 ± 3.49
5	10	223-227	150.82 ± 2.35

Here, the general tendency of the serum total cholesterol was to decrease in concentration as the age of the birds advanced in age except for the total cholesterol content of 129-133-days-old-birds.

The statistical analysis of the data on the concentration of serum total cholesterol in various age groups of White Leghorn birds is given in the analysis of variance table 4.12.

Table 4.12 Analysis of variance - Blood serum total cholesterol concentration in different age groups of White Leghorn birds.

Source	S.S	d.f	m.s.s	F
Age	5161.10	4	1280.277	140.135**
Error	6306.07	45	9.207	
Total	11467.17	49		

** Significance at 1% level.

The serum total cholesterol content of 223-227-days-old (150.52 ± 2.35 mg/100 ml) birds showed a significantly lower ($P < 0.01$) value when comparedto all the younger age group of birds. There was significantly lower ($P < 0.01$) serum total cholesterol content in 70-74-days-old (168.40 ± 5.65 mg/100ml) and 100-104-days-old (171.57 ± 1.47 mg/100 ml) birds when compared to 50-54-days-old (175.81 ± 3.52 mg/100 ml) birds. But the serum total cholesterol level in 100-104-days-old (171.57 ± 1.47 mg/100 ml) and 129-133-days-old-(179.73 ± 3.49 mg/100 ml) birds were significantly ($P < 0.01$) higher than that of 70-74-days-old (168.40 ± 5.65 mg/100 ml) birds.

The total lipids in the ovarian tissue of White Leghorn birds are given in table 4.13.

Table 4.13 Total lipids in the ovaries of different age groups of White Leghorn birds (Values are mean ± SE)

Sl.No.	No. of birds	Age in days	Total lipids (g/100gms)
1	10	50-54	8.27 ± 0.27
2	10	70-74	8.20 ± 0.30
3	10	100-104	14.79 ± 0.27
4	10	129-133	14.74 ± 0.30
5	10	223-227	16.21 ± 0.37

As in the case of cholesterol, the total lipid concentration in the ovarian tissue showed a tendency to rise with increase in age. However, this tendency was not very well evident as in the previous two instances of ovarian total cholesterol and ovarian phospholipids.

Statistical analysis of the data for the ovarian content of total lipids is given in the analysis of variance table 4.14.

No statistically significant difference in concentration of total lipids in the ovarian tissue was evident between the 50-54-days-old (8.27 ± 0.27 g/100 g) and 70-74-days-old (8.20 ± 0.30 g/100 g) birds. Similarly, in the ovary of the 100-104-

Table 4.14 Analysis of variance - Total lipids in the ovary of different age groups of White Leghorn birds.

Source	S.S	dif	m.s.s	F
Age	6034.72	4	1508.68	8.815**
Error	39.669	45	171.141	
Total	6074.389	49		

** Significance at 1% level.

days-old (14.79 ± 0.27 g/100 g), 129-133-days-old (14.74 ± 0.30 g/100 g) and 223-227-days-old (16.21 ± 0.37 g/100 g) birds also did not reveal any significant difference in between them. At the same time the younger age groups of 70-74-days-old-birds showed a significantly ($P < 0.01$) lower concentration of ovarian total lipids compared to that of 100-104-days-old and 223-227-days-old-birds. Similar was the case with 50-54-days-old-birds which showed a significantly lower value for the total lipid content in the ovaries compared to that of all the other higher age groups except that for the 70-74-days-old-birds.

The total lipid content in the liver of White Leghorn birds are given in table 4.15.

Table 4.15 Total lipids in the liver of different age groups of White Leghorn birds (Values are mean ± SE)

Sl.No.	No. of birds	Age in days	Total lipids (g/100gms)
1	10	50-54	7.65 ± 0.79
2	10	70-74	9.19 ± 0.48
3	10	100-104	14.00 ± 0.36
4	10	129-133	18.52 ± 0.37
5	10	223-227	21.15 ± 0.43

Liver total lipid content showed a tendency to increase in concentration as age advanced. Statistical analysis of the data on the concentration of liver total lipid in various age groups of White Leghorn birds is given in the analysis of variance table 4.16.

Table 4.16 Analysis of variance - Liver total lipid concentration in different age groups of White Leghorn birds.

Source	S.S	d.f	m.s.s	F
Age	13485.39	4	3871.34	13.75**
Error	61.90	45	245.65	
Total	13547.29	49		

** Significance at 1% level.

With pair wise comparison it was found that the liver total lipid content of 100-104-days-old (14.00±0.36g/100 g), 129-133-days-old (18.52± 0.37 g/100g) and 223-227 days-old (21.15±0.43g/100g) birds were all significantly ($P<0.01$) higher than that of 50-54-days-old (7.65±0.79g/100g) birds. The liver total lipids content of 129-133-days-old (18.52±0.37g/100g) and 223-227-days-old(21.15 ± 0.43g/100g) birds were significantly ($P<0.01$) higher than that of 70-74-days-old (9.18±0.48g/100g) birds.So also, significantly higher content (P 0.01) of liver total lipids concentration could be seen in 223-227-days-old (21.15±0.43g/100g) birds compared to that of 100-104-days-old (14.00±0.36g/100g) birds.

The blood serum concentration of total lipids in the White Leghorn birds are given in table 4.17.

Table 4.17. Concentrations of total lipids in the blood serum of different age groups of White Leghorn Birds (Values are mean ± S.E).

Sl.No.	No. of birds	Age in days	Total lipids(mg/100ml)
1	10	48	499.66 ± 7.25
2	10	77	613.33 ± 8.20
3	10	108	815.10 ± 13.25
4.	10	134	938.48 ± 8.13
5	10	230	1115.03 ± 10.25

The serum total lipid concentration in White Leghorn birds showed a noticeable increase as age of the birds advanced.

The statistical analysis of the data on the concentration of serum total lipids in various age groups of White Leghorn birds is given in the analysis of variance table 4.18.

Table 4.18 Analysis of variance - Blood serum total lipids concentration in different age groups of White Leghorn birds.

Source	SS	d.f.	m.ss.	F
Age	730889.10	4	182722.03	201.41**
Error	9072.00	10	907.00	
Total	739961.10	14		

**Significance at 1 % level.

The serum total lipid content in 230-days-old (1115.03 ± 10.25 mg/100ml), 134-days-old (938.48 ± 8.13 mg/100ml), 108-days-old (815.10±13.25 mg/100 ml) and 77-days-old (613.33 ±8.20 mg/100ml) birds were significantly ($P<0.01$) greater than that of 48-days-old (499.66±7.25 mg/100ml) birds. The results were similar when the data for the serum total lipids of higher age group were compared with that of 77-days-old (613.33 ± 8.20 mg/100 ml), 108-days-old (815.10 ± 13.25 mg/100 ml) and 134-days-old (938.48 ± 8.13 mg/100 ml) birds.

Table 4. 19 Correlations of phospholipids in the liver, ovary and serum.

	Liver	Ovary	Serum
Liver	1	0.781**	0.505**
Ovary		1	0.376**
Serum			1

Table 4.20 Correlations of total cholesterol in the ovary, liver and serum.

	Liver	Ovary	Serum
Liver	1	0.969**	0.326*
Ovary		1	0.309*
Serum			1

** Significance at 1% level.

* Significance at 5% level.

Table 4.21 Correlations of total lipids in the ovary, liver and serum.

	Liver	Ovary	Serum
Liver	1	0.896**	0.973**
Ovary		1	0.893**
Serum			1

Table 4.22 Correlations phospholipids, total cholesterol and total lipids in liver.

	Phospholipids	Total cholesterol	Total lipids
Phospholipids	1	0.873**	0.840**
Total cholesterol		1	0.951**
Total lipids			1

** Significance at 1% level.

Table 4.23 Correlations of phospholipids, total cholesterol and total lipids in ovary.

	Phospholipids	Total cholesterol	Total lipids
Phospholipids	1	0.862**	0.775**
Total cholesterol		1	0.896**
Total lipids			1

Table 4.24 Correlations of phospholipids, total cholesterol and total lipids in serum.

	Phospholipids	Total cholesterol	Total lipids
Phospholipids	1	0.184 NS	0.532**
Total cholesterol		1	0.490**
Total lipids			1

** Significance at 1% level.

* Significance at 5% level.

NS Not significant.

The results of the study on the effect of administration of DS, DS-PG and DS-PG-TD in 100-104-days-old White Leghorn pullets on the phospholipid content in ovaries are given in table 4.25.

Table 4.25 Concentrations of phospholipids in the ovary of 100-104-days-old White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± S.E).

Age in days	Tissue/site	No. of birds	Phospholipids (mg/g)			
			C	T1	T2	T3
100-104	Ovary	10	16.05 ±0.32	12.57 ±0.32	9.90 ±0.36	9.61 ±0.29

C = Control bird

T1 = Birds under the influence of DS

T2 = Birds under the influence of DS-PG

T3 = Birds under the influence of DS-PG-TD

Phospholipid concentration in ovaries showed a progressive decline in concentration in the experimental pullets and the greatest decrease compared to control value was obtained in pullets receiving DS-PG-TD.

The statistical analysis of the data on the phospholipids concentration is given in the analysis of variance table 4.26.

Table 4.26 Analysis of variance - concentrations of phospholipids in the ovaries of White Leghorn pullets treated with exogenous sex hormones.

Source	s.s	d.f	m.s.s	F
Treatments	268.346	3	89.448	79.439**
Error	40.536	36	1.126	
Total	308.882	39		

** Significance at 1% level.

In the present study the pullets receiving exogenous sex hormones in various combinations exhibited lower phospholipid concentrations in the ovaries compared to the control group of pullets. The pullets treated with DS (12.57 ± 0.32 mg/g), DS-PG (9.90 ± 0.36 mg/g) and DS-PG-TD (9.61 ± 0.29 mg/g), all showed a significantly lower (P 0.01) concentration of ovarian phospholipids compared to the control (16.05 ± 0.32 mg/g) pullets. However, there was no significant difference between

the phospholipid content of ovaries of DS-PG (9.90 ± 0.36 mg/g) pullets and DS-PG-TD treated (9.61 ± 0.29 mg/g) pullets.

The results of the study on the effect of administration of DS, DS-PG and DS-PG-TD on the phospholipid content in the liver in 100-104-days-old White Leghorn pullets are given in table 4.27.

Table 4.27 The phospholipid content in the liver of 100-104-days-old White Leghorn pullets under the influence of exogenous sex hormones. (Values are mean ± SE).

Age in days	Tissue/ site	No. of birds	Phospholipids (mg/g)			
			C	T1	T2	T3
100-104	Liver	10	18.84 ±0.56	22.79 ±0.73	38.13 ±0.53	32.40 ±0.37

C = Control birds

T1 = Birds under the influence of DS

T2 = Birds under the influence of DS and PG

T3 = Birds under the influence of DS, PG and TD

The liver phospholipids concentration was higher in those receiving DS alone, and a combination of DS and PG as compared to the control pullets.

The statistical analysis of the data on the liver phospholipid concentration isg given in the analysis of variance table 4.28.

Table 4.28 Analysis of variance - liver phospholipid concentration in White Leghorn pullets under the influence of exogenous sex hormones.

Source	S.S	d.f	m.s.s	F
Treatments	2330.003	3	776.668	253.81**
Error	110.174	36	3.060	
Total	2440.177	39		

** Significance at 1% level.

The DS treated (22.79 ± 0.73 mg/g) pullets, DS and PG treated (38.13 ± 0.53 mg/g) pulles and DS-PG-TP treated (32.40 ± 0.37 mg/g) pullets showed significantly ($P < 0.01$) higher contents of liver phospholipids compared to the control (18.84 ± 0.56 mg/g) group. Significantly higher ($P < 0.01$) content of liver phospholipid could be seen in DS-PG treated (38.13 ± 0.53 mg/g) pullets as compared to DS treated (22.79 ± 0.73 mg/g) and DS-PG-TP treated (32.40 ± 0.37 mg/g) pullets.

The results of the study on the effects of administration of DS, DS-PG and DS-PG-TD in 100-104-days-old White Leghorn pullets on the serum phospholipid content are given in table 4.29.

Table 4.29 Phospholipids in blood serum of 100-104-days-old-White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± SE).

Age in days	Tissue/ site	No. of birds	Phospholipids (mg/100ml)			
			C	T1	T2	T3
100-104	Serum	10	268.86 ±3.88	274.41 ±1.52	251.94 ±0.32	267.05 ±2.65

C = Control birds

T1 = Birds under the influence of DS alone

T2 = Birds under the influence of DS-PG

T3 = Birds under the influence of DS-PG-TD

The DS treated birds showed a higher concentration of serum phospholipids compared to the control group of birds The other two experimental groups showed lower concentration of serum phospholipids compared to the control birds.

Statistical analysis of the data on the serum phospholipid concentration is given in the analysis of variance table 4.30.

Table 4.30 Analysis of variance- concentration of blood serum phospholipids in White Leghorn pullets treated with exogenous sex hormones.

Source	s.s	d.f	m.s.s	F
Treatment	2821.256	3	949.418	14.656**
Error	2309.914	36	64.164	
Total	5131.170	39		

** Significance at 1% level.

The DS treated (274.71 ± 1.52 mg/100 ml) pullets showed a significantly ($P < 0.01$) higher value for serum phospholipids than the control group (268.86 ± 3.88 mg/100 ml). At the same time the DS-PG (251.94 ± 0.32 mg/100 ml) and the DS-PG-TP treated (267.05 ± 2.65 mg/100 ml) pullets showed a significantly ($P < 0.01$) lower concentrations of serum phospholipid compared to the control group (268.86 ± 3.88 mg/100 ml).

The results of the study on the effects of administration of exogenous sex hormones in 100-104-days-old White Leghorn pullets on the total cholesterol concentration in the ovaries are given in table 4.31.

Table 4.31 Total cholesterol in the ovaries of 100-104-days-old White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± SE).

Age in days	Tissue/ site	No. of birds	Total cholesterol			
			C	T1	T2	T3
100-104	Ovary	10	10.14 ±0.32	3.55 ±0.16	3.63 ±0.16	4.03 ±0.22

C = Control birds

T1 = Birds under the influence of DS

T2 = Birds under the influence of DS-PG

T3 = Birds under the influence of DS-PG-TD

Here also, the general tendency to show a decrease in the content of total cholesterol in the ovaries of the pullets, treated with exogenous sex hormones was evident. The greatest decrease in cholesterol was observed in the DS treated birds compared to the control group.

Statistical analysis of the data on the total cholesterol concentration in the ovaries is given in the analysis of variance table 4.32.

Table 4.32 Analysis of variance - total cholesterol in the ovaries of White Leghorn pullets treated with exogenous sex hormones.

Source	s.s	d.f	m.s.s	F
Treatment	309.093	3	103.031	242.273**
Error	15.309	36	0.425	
Total	324.402	39		

** Significance at 1% level.

Total cholesterol content in the ovaries of DS treated (3.55 ± 0.16 mg/g) DS-PG treated(3.63 ± 0.16 mg/g) and DS-PG-TD treated (4.03 ± 0.22 mg/g) pullets showed significantly lower value ($P < 0.01$) from that of control (10.14 ± 0.32 mg/g) group of birds. The DS-PG treated pullets (3.63 ± 0.16 mg/g) showed significantly higher value when compared to DS treated (3.55 ± 0.16 mg/g) birds. Similarly there was significantly ($P < 0.01$) higher contents of total cholesterol in the ovaries of DS-PG-TD treated pullets (4.03 ± 0.22 mg/g) compared to DS-PG (3.63 ± 0.16 mg/g) treated pullets.

The results of the study on the effect of administration

of exogenous sex hormones in 100-104-days-old White Leghorn pullets in the liver total cholesterol are given in the table 4.33.

Table 4.33 Total cholesterol in the liver of 100-104-days-old White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± S.E).

Age in days	Tissue/ site	No. of birds	Total cholesterol (mg/g)			
			C	T1	T2	T3
100-104	Liver	10	12.95 ±0.42	17.19 ±0.37	28.53 ±0.76	32.29 ±0.61

C = Control birds

T1 = Birds under the influence of DS alone.

T2 = Birds under the influence of DS-PG

T3 = Birds under the influence of DS-PG-TD.

The values for the total cholesterol content of liver showed a tendency to increase when all the three exogenous hormones were administered together rather than when one or two only were administered.

The statistical analysis of the data on the total cholesterol in liver is given in the analysis of variance table 4.34.

Table 4.34 Analysis of variance - Total cholesterol in liver in White Leghorn pullet treated with exogenous sex hormones.

Source	s.s	d.f	m.s.s	F
Treatments	2514.768	3	838.256	286.207**
Error	105.438	36	2.928	
Total	2620.206	39		

** Significance at 1% level.

All the three group, DS treated (17.19 ± 0.37 mg/g), DS-PG treated (28.53 ± 0.76 mg/g) and DS-PG-TD treated (32.29 ± 0.61 mg/g) pullets showed significantly ($P < 0.01$) higher contents of liver total cholesterol when compared to control (12.95 ± 0.42 mg/g) group of pullets. DS-PG treated (28.53 ± 0.76 mg/g) pullets and the DS-PG-TD treated (32.29 ± 0.61 mg/g) pullets showed high total cholesterol in liver, compared to DS treated 17.19 ± 0.37 mg/g) pullets. So also, there was significantly higher ($P < 0.01$) contents of liver total cholesterol in the DS-PG-TD treated pullets (32.29 ± 0.61 mg/g), compared to the total cholesterol in liver in the DS-PG

treated (28.53 ± 0.76 mg/g) pullets.

The results of the study on the effects of exogenous sex hormones in 100-104-days-old White Leghorn pullets on the blood serum total cholesterol content are given in table 4.35.

Table 4.35 Total cholesterol in the blood serum of 100-104-days-old White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± SE).

Age in days	Tissue/ site	No. of birds	Total cholesterol (mg/100 ml)			
			C	T1	T2	T3
100-104	Serum	10	171.57 ±1.47	143.19 ±1.53	150.23 ±0.93	178.76 ±0.67

C = Control birds

T1 = Birds under the influence of DS alone.

T2 = Birds under the influence of DS-PG

T3 = Birds under the influence of DS-PG-TD

In general the administration of exogenous sex hormones produced significantly ($P < 0.01$) different levels of serum total cholesterol concentration in the experimental group of birds.

The statistical analysis of the data on the total cholesterol in blood serum is given in the analysis of variance table 4.36.

Table 4.36 Analysis of variance - Total cholesterol in blood serum of White Leghorn pullets treated with exogenous sex hormones.

Source	S.S	d.f	m.s.s	F
Treatment	8604.432	3	2868.144	147.176**
Error	701.558	36	19.487	
Total	9305.990	39		

** Significance at 1% level.

There was significantly ($P < 0.01$) higher concentrations of serum total cholesterol in the DS-PG-TD treated (170.76 ± 0.67 mg/100 ml) pullets compared to DS treated (143.19 ± 1.53 mg/100 ml) pullets, DS-PG treated (150.23 ± 0.93 mg/100 ml) pullets and the control group (171.57 ± 1.47 mg/100 ml). However, significantly lower ($P < 0.01$) total cholesterol concentration in serum was noticed in DS treated (143.19 ± 1.53 mg/100 ml) pullets compared to DS-PG treated (150.23 ± 0.93 mg/100 ml) pullets.

The results of the study on the effects of exogenous sex hormones on the total lipid content in ovaries of 100-104-days-old White Leghorn pullets are given in table 4.37.

Table 4.37 Total lipids in the ovary of 100-104-days-old White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± SE).

Age in days	Tissue/ site	No. of birds	Total lipids			
			C	T1	T2	T3
100-104	Ovary	10	14.79 ±0.27	14.70 ±0.51	15.37 ±0.44	16.45 ± 0.15

C = Control birds

T1 = Birds under the influence of DS alone.

T2 = Birds under the influence of DS-PG

T3 = Birds under the influence of DS-PG-TD

DS-PG-TD treated group of White Leghorn pullets showed a higher content of total lipids in their ovaries, compared to the other three groups of pullets.

The statistical analysis of the data on the total lipid content in the ovaries of White Leghorn pullets is given in the analysis of variance table 4.38.

Table 4.38 Analysis of variance total lipid content in the ovaries of White Leghorn pullets treated with exogenous sex hormones.

Source	S.S	d.f	m.s.s	F
Treatment	19.408	3	6.469	5.37**
Error	43.359	36	1.204	
Total	62.767	39		

** Significance at 1% level.

There was significant increase ($P < 0.01$) in the total lipid concentration in the ovaries of the DS-PG treated (15.37 ± 0.44 g/100g) pullets and DS-PG-TD treated (16.45 ± 0.15 g/100 g) pullets compared to the control (14.79 ± 0.27 g/100 g) group of pullets. The total lipid concentration in the DS-PG-TD treated (16.45 ± 0.15 g/100 g) pullets was significantly ($P < 0.01$) higher when compared to DS treated (14.70 ± 0.51 g/100 g) and DS-PG treated (15.37 ± 0.44 g/100 g) pullets.

The results of the study on the effects of administration of exogenous sex hormones in 100-104-days-old White Leghorn pullets on the total lipid content of the liver are given in table 4.39.

Table 4.39 Concentrations total lipids of liver of 100-104-days-old White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± S.E).

Age in days	Tissue/ site	No. of birds	Total lipids (g/100 g)			
			C	T1	T2	T3
100-104	Liver	10	14.00 ±0.36	18.20 ±0.39	25.56 ±0.29	26.82 ±0.22

C = Control birds

T1 = Birds under the influence of DS alone.

T2 = Birds under the influence of DS-PG.

T3 = Birds under the influence of DS-PG-TP.

The total lipids of liver showed a tendency to increase in concentration when all the three exogenous hormones were administered together, compared to conditions where one or two hormones only were given.

The statistical analysis of the data on the liver total lipid concentration is given in the analysis of variance table 4.40.

There was significantly higher ($P < 0.01$) content of total lipids in the liver of DS treated (18.20 ± 0.34 g/100 g), DS-PG

Table 4.40 Analysis of variance - Concentrations of liver total lipid in White Leghorn pullets treated with exogenous sex hormones.

Source	S.S	d.f	m.s.s	F
Treatments	1113.475	3	371.156	388.907*
Error	34.357	36	0.954	
Total	1147.832	39		

** Significance at 1% level.

treated (25.26 ± 0.29 g/100 g) and DS-PG-TD (26.82 ± 0.22 g/100g) treated pullets compared to the control (14.00 ± 0.36 g/100 g) group. Similarly, there was significantly higher ($P < 0.01$) concentrations of hepatic lipids in DS-PG treated (25.56 ± 0.29 g/100 g) and DS-PG-TD treated (26.82 ± 0.22 g/100 g) compared to DS treated (18.20 ± 0.39 g/100g) White Leghorn pullets.

The results of the study on the effect of administration of exogenous sex hormones in the total lipids of blood serum in 100-105-days-old White Leghorn pullets are given in table 4.41.

Table 4.41 Total lipids of serum in 108-days-old White Leghorn pullets under the influence of exogenous sex hormones (Values are mean ± S.E)

Age in days	No. of birds	Site	Total lipids (mg /100 ml)			
			C	T1	T2	T3
108	10	serum	815.10 ±13.23	901.85 ±7.28	953.65 ±8.25	962.00 ±9.05

C =, Control birds

T1= Birds under the influence of DS alone

T2= Birds under the influence of DS-PG.

T3= Birds under the influence of DS-PG-TP.

Pullets receiving DS, DS-PG,and DS-PG-TP showed nigher concentrations of totallipids of blood serum than the control group.

The analysis of the data on the blood serum total lipids is given in the analysis of variance table 4.42.

There was significantly ($P<0.01$) higher concentration of total lipids in the blood serum of DS-PG treated (953.65 ±8.25 mg/100 ml) and DS-PG-TP treated (962.00±9.05 mg/100ml) pullets compaired to the control group (815.10±13.25 mg/ 100 ml). Similarly, there was significantly higher ($P<0.01$) content of serum total lipid in DS-PG-TP treated

Table 4.42. Analysis of variance - Total lipids of blood serum in White Leghorn pullets treated with exogenous sex hormones

Source	SS	Df	M.s.s.	F
Treatment	4259.185	3	1419.715	29.032**
Error	2320.830	36	74.465	
Total	6580.015	39		

**Significance at 1 % level

(962.00 ± 9.05 mg /100 ml) pullets compared to DS-PG treated (953.65 ± 8.25 mg/100 ml) birds. However, total lipids in blood serum in the DS treated (901.85 ± 7.28 mg / 100 ml) pullets were significantly ($P<0.01$) lower than the control (815.10 ± 13.25 mg/100 ml) group of pullets.

MORPHOLOGICAL CHANGES INDUCED BY THE ADMINISTRATION OF DIFFERENT COMBINATIONS OF EXOGENOUS SEX HORMONES IN 100-104-DAYS-OLD WHITE LEGHORN PULLETS.

White Leghorn pullets receiving DS, showed a higher body weight (1.117 kgs) than the control group (0.839kgs) ofbirds.

The highest body weight was observed in pullets receiving DS-PG-TD (1.135 kgs).

The body weights of birds of the different experimental groups before the starting of the experiment are given in table 4.43(a).

Table 4.43(a) Body weights of birds of the different experimental group before the starting of the experiment.

No. of Control birds	Birds intended for oestrogen treatment.	Birds intended for oestrogen and progesterone treatment	Birds intended for oestrogen, progesterone and testosterone treatment.
	g/bird	g/bird	g/bird	g/bird
10	856	857	860	859

The data on the body weights of control group of birds and that of experimental group of birds receiving different combinations of exogenous sex hormones are given in table 4.43(b).

Table 4.43(b) Body weights of 100-104-days-old White Leghorn pullets after the administration of exogenous sex hormones (Values are mean ± SE).

Table 4.43(b) Body weights of birds of the different experimental groups after the completion of the experiment.

No. of birds	C*(Kgs)	T1**(Kgs)	T2***(Kgs)	T3****(Kgs)
10	0.839 ± 0.010	1.117 ± 0.006	1.095 ± 0.017	1.135 ± 0.005

C - Control group of birds.
T1** - Birds under the influence of DS alone.
T2*** - Birds under the influence of DS-PG.
T3**** - Birds under the influence of DS-PG-TD.

Birds receiving DS-PG recorded an increase in body weight (1.095 kgs) compared to DS treated birds (1.117 kgs). At the same time experimental birds receiving all the three exogenous sex hormones recorded the highest body weight (1.135 kgs) compared to the control group of birds (0.839 kgs).

The pullets receiving DS-PG-TD together (Fig.1) were more docile than the other pullets. DS alone treated pullets also showed a certain degree of docility (Fig.II). The development of comb and wattles was more in birds receiving DS-PG-TD (Fig.1) compared to the other groups receiving DS and DS-PG. It may be noticed that DS treated birds also showed a certain degree of development of the comb and wattles, but not as marked as that in the case of those receiving DS-PG-TD.

When the birds were sacrificed and eviscerated, the mesentry of the treated birds showed marked deposition of

fat compared to the control group of birds. Fat accumulation was evident around the gizard in all three groups of birds.

The highest liver weight was obtained in DS-PG-TD treated birds (50.427 gms). The liver weights of the controls and the hormone treated birds are given in table No. 4.44. The moisture and dry matter content of the liver are given in table No. 4.45.

The weight of the ovaries did not show much variation in the experimental group compared to the control birds. The weight and the dry matter content of the ovary are given in table No. 4.46 and No. 4.47 respectively.

Table 4.44 Liver weights of 100-104-days-old White Leghorn pullets after the administration of exogenous sex hormones (Values are mean ± SE).

No. of birds.	C*(gs)	T1**(Gs)	T2***(gs)	T3****(gs)
10	48.686 ±0.76	47.503 ±0.57	48.969 ±0.837	50.427 ±0.596

C = Control group of birds
T1** = Birds under the influence of DS alone
T2*** = Birds under the influence of DS-PG.
T3**** = Birds under the influence of DS-PG-TD

Table 4.45 Moisture content and drymatter content of 100-104-days-old White Leghorn pullets treated with exogenous sex hormones (Values are mean ± SE)

	C*		T1**		T2***		T3****	
No.	Moisture %	Drymatter %	Moisture %	Drymatter %	Moisture %	Drymatter %	Moisture %	Drymatter %
10	65.78 ±0.70	34.41 ±0.70	65.87 ±0.63	34.12 ±0.63	65.69 ±0.54	34.30 ±0.54	65.66 ±0.84	33.73 ±0.58

C = Control group of birds

T1** = Birds under the influence of DS alone

T2*** = Birds under the influence of DS-PG

T3**** = Birds under the influence of DS-PG-TD

Table 4.46 Weight of ovaries of 100-104-days-old White Leghorn pullets treated with exogenous sex hormones (Values are mean ± SE).

No.	C* (mgs)	T1** (mgs)	T2*** (mgs)	T3**** (mgs)
10	199.2 ±1.0	203.4 ±1.0	198.5 ±0.9	201.3 ±1.1

C = Control group of birds

T1** = Birds under the influence of DS alone.

T2*** = Birds under the influence of DS-PG.

T3**** = Birds under the influence of DS-PG-TD

Table 4.47 Moisture content and dry matter contents of 100-104-days-old White Leghorn pullets treated with exogenous sex hormones (Values are mean ± SE).

	C*		T1**		T2***		T3***	
No.	Moisture %	Dry matter %	Moisture %	Dry matter %	Moisture %	Dry matter %	Moisture %	Dry matter %
10	67.34 ±0.52	32.65 ±0.52	66.47 ±0.71	33.53 ±0.71	66.64 ±0.57	33.35 ±0.57	67.17 ±0.50	32.82 ±0.50

C* = Control group of birds.

T1** = Birds under the influence of OS alone.

T2*** = Birds under the influence of OS-PG

T3**** = Birds under the influence of OS-PG-TO

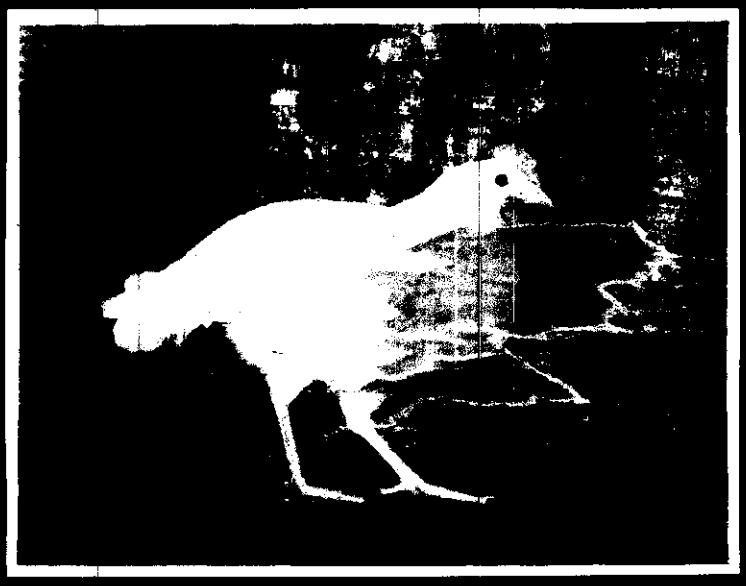

Fig. I. Birds under the influence of Diethylstilbestrol, Progesterone and Testosterone dipropionate

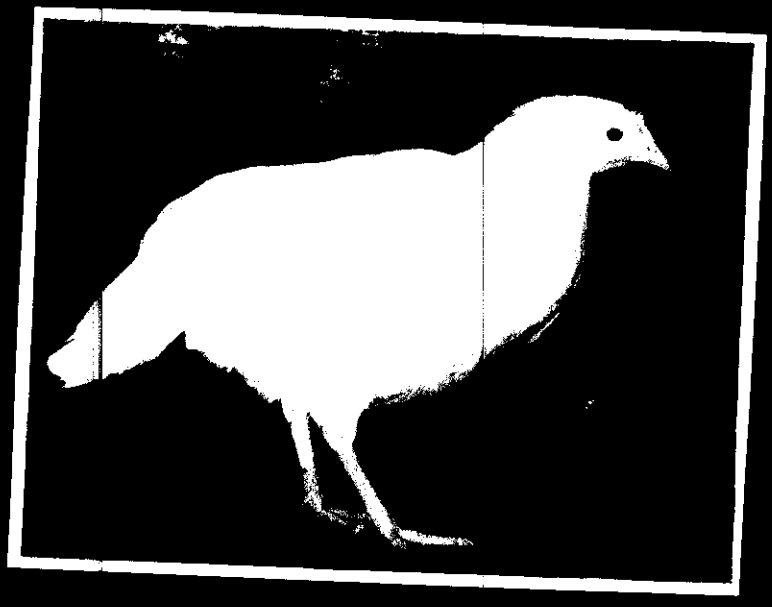

Fig. II. Birds under the influence of Diethylstilbestrol and Progesterone.

DISCUSSION

DISCUSSION

Sturkie (1958) reported that in birds oestrogen secretion produced an increased content of low density lipoproteins, mostly comprising of phospholipids which are deposited in the ovary as the bird attained maturity. The results of the present investigation on ovarian content of phospholipids showed a similar increase as the age advanced. A significally higher increase in ovarian phospholipid concentration was noticed in 50-54-days-old birds upto 100-104-days-old birds. As the birds grew older, the ovarian concentration of oestrogen may be progressively increasing resulting in more and more syntheses and deposition of phospholipids in the ovarian tissue.

The hepatic phospholipid concentration has been shown to increase as the age of the bird increased (Thayer et al., 1973). Taurog, et al. (1944) have shown that oestrogen administration caused an increase in the hepatic phospholipid concentration. Increased liver phospholipid content obtained in the present investigation, as the bird advanced in age, may be due to the influence of age. There may be increase in the concentration of sex hormones, as the birds advance in age, which may also assist the higher concentrations of phospholipids in the liver.

A mild hyperlipidemia in the blood serum of layers at the onset of laying which returned to an almost normolipidemic level with continuous egg production was noticed by

Simon Cho (1981). The values of blood serum phospholipids in the White Leghorn birds in the study showed an increase as the age advanced. However, the corresponding values in the 223-227-days-old layers was less than that of 129-133-days-old birds. This decreased level of phospholipids in the layers may be indicative of the particular time during which the laying processes had been at its low level, representing a period where there was a return of the layers to normolipedemic level as stated by Simon Cho (1981) above.

Accumulation of solids including cholesterol during maturation has been noticed in the avian ovary (Marion and Sell, 1963). Entenmann, et al. (1940) have shown that the occurance of increased concentration of cholesterol in ovarian tissue could be due to an increased secretion of sex hormones as age of the bird advanced. The progressive increase in the ovarian total cholesterol in the birds in this study may be due to the effect of age as a result of which the concentration of oestrogen and other sex hormones might have been increasing. Spencer (1971) showed that the total quantity of cholesterol deposited in each egg remained more or less constant. This may indicate that there may be a definite quantity of cholesterol transferred from the liver to the ovary before the formation of every egg. There are evidences to show that cholesterol is being transferred and deposited in the ovary and

that there is no actual syntheses of cholesterol in the ovarian tissue itself.

Ikegwuanu and Aire (1977) noticed that testicular content of cholesterol in birds was at its peak just before maturity, followed by a decline afterwards. This may be true in the case of females of this species also, because cholesterol content was progressively increasing as the birds grew older as was evidenced by the highest content of ovarian total cholesterol in layers in the present investigation.

Heldman and Granthman (1964) established that as age advanced there was increased syntheses of cholesterol within the liver or mobilisation of cholesterol to the liver from else where in the body. It has been noticed that sex hormones influenced the cholesterol content of the liver tissue which was shown to increase as age advanced (Entenmann et al., 1940). In addition to the gonads, the adrenals have also been implicated in the regulation of hepatic lipogenesis (Entenmann et al., 1940). Most of the cholesterol in the egg has been found to be synthesised in the livers of birds (Naber, 1976). The progressive increase in the total cholesterol in the liver of birds during this investigation may be due to this type of an augmented lipogenesis in the liver which also might have been influenced by a quantitative increase in the secretions of adrenals and sex glands as the birds became older.

The serum cholesterol level in younger birds had been reported not to fluctuate with age (Spencer, 1971). But the results of the present study showed significant difference ($P < 0.01$) in the case of serum total cholesterol content between 50-54-days-old-birds and the layers and this effect might be due to the effects of sex hormones which are likely to be at their peak during laying. Common et al. (1946) reported that the higher concentrations of serum lipids including cholesterol are seen as the birds which attained sexual maturity and they attributed this to the synergistic effects of oestrogens, androgens and progesterone.

Hafez and Kamar (1955) noticed that the ovaries were very small size during the early stages in the birds and that they increased rapidly in size and weight as they attained maturity. This increased weight of ovaries at the age of sexual maturity in birds was attributed to the deposition of lipids in the ovary in response to sex hormones. This may therefore be the reason for the increase in the total lipid content of the ovary as the bird attained sexual maturity. In the White Leghorn birds studied it was found that the ovarian total lipid content showed an increase with age. This may be due to the fact that when oestrogens are produced in increasing concentration, as age advanced, the hormone might be playing an important role in the mobilisation of fat to the ovary (Nalbadov, 1953).

In the present study there was a progressive increase in the concentration total lipids in the liver in 50-54-days-old to 221-227 -days-old birds. Goodridge (1968) has shown that the higher liver lipid content in laying birds was due to increased lipogenesis occurring in the liver.

Egg yolk formation in the ovary is dependent on lipids synthesised in the liver and transported as lipoproteins to the ovarian follicles (Badman, 1961). Entenmann et al.(1940) demonstrated that as the bird advanced in age there might have been a progressive increase in hepatic lipogenic activity characterised by increased total lipid in liver to meet the ultimate requirement of yolk formation for the development of eggs. In the present study, significally higher concentration of total lipid of liver was noticed in the 129-133-days-old-birds as compared to the 70-74-days-old-birds. Increased liver content of total lipid in laying hens has also been noticed by McIndoe (1959).

Heald and Badman (1963) indicated that concentrations in the plasma lipids was greatest at 14 days preceding egg laying and that at the onset of laying there was a sharp fall in the plasma lipid level. The birds under study showed a sharp increase in the serum total lipids contents as they attained sexual maturity, there after the increase was less marked. Shivaprasad and Jaap (1977) reported that the concentration of lipids in the blood was not closely related to egg

yolk formation. But the size of the liver and the ability of the liver to produce lipoproteins were considered to be more important for the regulation of its concentration in the blood serum (Shivaprasad and Jaap, 1977). It may be inferred that as the bird grew older the body size increased so also the liver size. The parallel increase in the case of serum total lipids as the age advanced may be due to the effect of age and due to the hyperlipemia produced subsequent to the increased activity of the hepatic tissue.

Lorenz and Chaikoff (1940) reported significantly different correlations existing in the ovarian and hepatic total cholesterol in the same age group of birds. The analysis of the data from the present investigation showed that in the liver as well as in the ovary there was a direct correlation between total cholesterol content and phospholipid content. Further more, there was a positive correlation existing between the ovarian and liver total cholesterol and between the ovarian and serum total cholesterol contents. However, in the serum there was no evidence for positive correlation between the phospholipid and the total cholesterol contents. This may be due to the fact that blood which is circulating through the entire body may be supplying phospholipids and cholesterol quantitatively in a selective manner to the different tissues as and when required by them. Speers and Balloun (1966) reported that there was a significant direct correlation

existing between the liver total lipid content and the rate of egg production.

It was found from the study that there was a significant direct correlation between hepatic, ovarian and serum total lipids, though the total lipid concentration of ovary was less than that of the liver.

Positive correlation existed in the phospholipid concentration of the birds under investigation the liver, ovary and serum. This may indicate increased syntheses of the components in the liver, their augmented transport by the blood to meet the increased requirement of the ovary which is developing rapidly to get itself prepared for egg production.

So, it may be concluded from the results of the present investigation that there was increased concentrations of phospholipids, total cholesterol and total lipids as the age of the bird advanced in the liver as well as in the ovary. This may be considered as a stepping stone for the birds to get themselves well equipped for egg production.

Lorenz et al. (1944) have established that following treatment with stilbestrol there was significant increase in the hepatic phospholipid content in birds. Nalbarelor (1953) has shown that oestrogenisation of cockerels resulted in lipemia and an increased hepatic content of phospholipids, total cholesterol and neutral fats. The results of the present study showed

that the birds treated with DS alone, DS-PG together and DS-PG-TD combination showed higher concentrations of phospholipids in the liver compared to the control birds. However, the highest amount of phospholipid in the liver was observed in DS-PG treated birds group. This may indicate that the synergistic effect was most effective in this combination of hormones than DS-PG-TD combination.The results are suggestive of an increased formation of phospholipid in the liver, making lipemia possible by administration of sex hormone in the birds. Other steriods like androgens and progesterone, given alone were shown to be unable to duplicate the results produced by the administration of oestrogens (Lorenz et al., 1954).

Cholesterol and fatty acid syntheses were found to be highly active in chick liver (Goodridge., 1968b). However, the incorporation of the carbon atom of glucose into fatty acids and cholesterol has been found to be very low in the embryonic chick liver. But the incorporation took place at an increased rate on hatching, feeding and after administration of sex hormones (Goodridge, 1968b). The results of the present investigation revealed higher concentration of total cholesterol in the liver in DS treated birds, DS-PG treated birds and DS-PG-TD treated pullets. The highest concentration was observed in DS-PG-TD treated pullets. There were significant differences ($P < 0.01$) between DS treated, DS-PG treated and DS-PG-TD treated pullets in the liver total cholesterol

content. Apart from the effects of hatching and feeding, (Goodridge, 1968b) this effect might have been due to the effect of sex hormones, the synergistic effect being highest in the combination of all the three exogenous sex hormones.

Hood et al. (1950) showed that diethylstilbestrol administration resulted in significantly higher deposition of fat in the liver of birds compared to the control group of birds. Combs et al. (1958) found that turkeys receiving diethylstilbestrol pellets subcutaneously gained weight with appreciable difference in the feed consumption per unit of weight gain. This increase in weight was indicative of fat deposition in the body. Further it has been indicated that treatment with diethylstilbestrol resulted in increased liver weight, liver lipid accumulation and abdominal fat deposition in 3 to 4 months old pullets (Combs et al., 1958). All the birds receiving exogenous sex hormones in the present investigation showed higher content of liver total lipids than the control birds. The DS-PG treated birds showed a higher liver total lipid concentration than DS treated birds. The DS-PG-TD treated birds recorded the highest value for liver total lipid among the different groups of birds receiving exogenous sex hormones. The results suggested the existance of a better synergistic effect by a combination of all the three sex hormones than the administration of a single hormone

alone or a combination of two among them. Starrier et al. (1950) pointed out that oestrogen influenced lipid metabolism by increasing lipid syntheses along with decreased lipid dissipation from the liver. This is likely to enhance the accumulation of fat in the hepatic tissue.

When White Leghorn hens were administered oestrogen (300 mg/bird) lesser ovarian activity and lowered egg production were evident (Tienore, 1958). The lesser concentration of ovarian phospholipids in the present study may be taken as an index of lowered ovarian activity induced by the exogenous sex hormones.

Cook et al. (1957) observed an inhibitory effect of testosterone on the plasma cholesterol level in White Leghorn hens. Further, they have noticed that when DS-TD were given together the serum total cholesterol content recorded a decrease. The ovarian total cholesterol content in this study showed a decrease in the birds receiving exogenous sex hormones. The lower concentration of ovarian total cholesterol was noticed both in DS treated pullets and DS-PG-TD treated pullets compared to the control group. The lesser total cholesterol content in the ovaries may be the result of the lowered concentration of serum total cholesterol induced by the administration of sex hormones, since the ovaries derive their share of cholesterol from the blood.

Higher content of total lipid in ovaries was noticed in DS-PG and DS-PG-TD treated pullets compared to the control pullets. However, there was no significant difference between the control group of birds and birds treated with DS alone in the case of total lipid concentration in the ovaries. The higher concentration of ovarian total lipids in the DS-PG and DS-PG-TD treated pullets may be due to the synergistic effect of the hormones.

Bell and Freeman (1971) have stated that fat synthesised in the liver was transported to other tissues as lipoproteins and that plasma lipoproteins were the actual precursors for the formation of egg yolk in laying hens. Schjeide and Urist (1956), Schjeide et al. (1963) and Schjeide and Wilkens (1969) showed that there was a great increase in the level of low density lipoproteins and a decrease in the high density components in the plasma when the birds attained sexual maturity. Cook (1968) reported that egg yolk contained large amount of lipoproteins similar in density characteristics to plasma low density lipoproteins. Lipemia in immature and mature bird of both sexes could be caused by the injection of sex hormones (Entenmann et al., 1938) and by synthetic oestrogenic hormones. Common et al. (1946) have given evidence to show that changes in plasma proteins occurred due to the synergistic effects of oestrogens, androgens and progesterone. Serum phospholipid concentration was significantly (P 0.01)

higher in birds treated with DS alone compared to all other experimental and control groups of pullets. This could be due to the effect of oestrogens increasing the rate of phospholipid formation in the liver leading to lipemia probably due to higher liberation of phospholipids in the blood (Entenmann et al., 1938). The birds as they attained maturity increase the production of sex hormone. This may be the reason why the sexually mature birds (Schjeide et al. 1963) showed lipemia and a similar effect might have been produced in the experimental birds in this study due to the administration of oestrogen.

Cook et al. (1957) observed an inhibitory effect of testosterone in the plasma cholesterol level. Further they have noticed that when DS+TD were given together the serum total cholesterol content was significantly reduced as, the value compared to the control birds. The results of this study indicated a similar effect on the serum total cholesterol level which recorded a lower concentration compared to the control birds.

Nalbandov (1953) noticed an increased serum lipid concentration due to the administration of oestrogen. Results of this investigation showed the highest serum total lipid level in birds treated with DS+PG+TD together. Moreover, increased

concentration of serum total lipids was seen in DS-PG treated birds compared to the control group while the birds treated with DS alone showed no significant difference in the serum total lipid concentration. This may indicate that for maximum mobilization of lipids, oestrogen alone may be insufficient, a combination of other hormones like progesterone and androgens may also be required.

Helbacka and Romoser (1958) reported that there was significant increase in the body weight of diethylstilbestrol treated birds. The results of this study showed that the birds receiving sex hormones showed significantly ($P<0.01$) higher liver weight and body weight compared to the control birds. Further, Combs et al. (1958) showed that treatment with the diethylstilbestrol resulted in increased liver weight and abdominal fat deposition in White Leghorn birds. The liver weight, its dry matter content and the body weight were the highest in DS-PG-TD treated birds compared to the control birds.

There was insignificant difference in the case of ovarian weight and dry matter content of ovary between control and experimental group of pullets. This may be due to the insufficient quantity of gonadotropins (Pillai and Nirmalan, 1979) at the age of the birds at which the investigation were carried out.

In the growing birds there was progressive increase in the phospholipid content in the ovaries. Goodridge (1968) has shown that in embryonic chick lipogenesis was slight in the liver which increased after hatching and feeding. This lipogenic activity in the liver is maintained throughout life and is influenced by diet and hormonal factors. It is well known that the synthesis of lipids by the liver is increased in response to hormonal changes accompanying the onset of lay (Bell and Freeman, 1971). Since the lipids are synthesized in the liver and the ovaries derive the lipids from the liver through the circulating blood, the progressive increase in phospholipid in the ovary may be due to the increased lipogenesis in the liver (Taurog et al., 1944). This might have resulted in augmented transport of the phospholipids by the blood and their added deposition in the ovaries. However, the pullets under the influence of exogenous sex hormones did not reveal a similar increase in phospholipid content in their ovaries. Under normal conditions the gonadotrophins, released from the adenohypophysis control the growth and development of the ovaries. When exogenous sex hormones are administered, the normal release of gonadotrophins will be modified by the negative feed-back mechanism. This may prevent the normal growth, development and activities of the ovaries resulting in the lowered transfer of phospholipid to the ovaries.

The cholesterol content in the ovaries increased with the age of the birds. This may be due to the general growth and development attained as age advanced along with the increased secretion of hormones, both sexual and metabolic, leading to increased deposition of cholesterol in the ovaries. The formation of cholesterol in the liver was also increasing with the age of the birds. However the administration of exogenous sex hormones, while increasing the liver content of cholesterol, decreased that in the ovaries. This may again point out the operation of a negative feed-back mechanism operating between the artificially induced increase in content of sex steroids in the body and the pituitary gonadotrophins resulting in the lowered activity of the ovaries. Further, Cook et al. (1957) have noticed an inhibitory effect of testosterone on the plasma cholesterol level in birds. The age also influenced the serum cholesterol level which increased as the birds grew old. The increased cholesterol level in the liver is also a contributory factor. But the serum cholesterol content in the pullets receiving exogenous sex hormones requires further study to clarify the situation present in the blood. The higher cholesterol content in the liver and the lower cholesterol level in the ovaries might have naturally given rise to hypercholesterolemia, provided all the other conditions remained the same. This requires further study to clarify the observation.

The content of total lipids in the ovaries increased with the age and on the administration of exogenous sex hormones. Similar was the case with respect to both liver and blood serum levels of total lipids. The growth and development of the body as a whole might have induced an increased total lipid content in all the tissues studied (Nalbandov, 1953., Combs et al., 1958, Held and Badman, 1963). Synergistic effect of exogenous sex hormones on the deposition of total lipids in the liver and serum lipid concentration was evident in this study. But the negative feed-back mechanism operating in the previous two instances, the phospholipid and cholesterol content in the ovaries, is not seen operating in this case. Further studies are required to clarify this aspect of the study.

SUMMARY

SUMMARY

An assessment of lipid constituents in ovary, liver and blood serum of White Leghorn fowls was investigated to throw light on the various aspects of lipid transfer occurring in the ovary of birds. Phospholipids, cholesterol and total lipid contents were estimated in different age groups of birds ranging in age from 50-54-days to 223-227-days. Exogenous sex hormones like diethyl stilbestrol, progesterone and testosterone dipropionate were administered to 100-104-days-old pullets so as to ascertain the effect of exogenous hormones on the level of the above lipid in the various tissues mentioned before.

The phospholipid, total cholesterol and total lipid levels in the ovary, liver and blood serum showed an increase as the age of the birds advanced. This may be a function of age itself, wherein the level of various metabolic and sex hormones are on the increase. The progressively increasing levels of hormones stimulated lipogenesis in the liver, providing conditions for their augmented delivery to various tissues in the body, by way of the circulating blood. Since the ovaries derive their lipid components from the circulating blood serum the high levels of lipids in the serum might have been instrumental in producing the higher content of lipid materials in the ovaries.

However, the birds receiving exogenous sex hormones in different combinations, produced higher content of the lipid

components in the liver and blood serum. But in the ovaries, significantly lower levels of phospholipid and cholesterol were evident. This might have been due to the operation of the negative feed-back mechanism between the gonadotrophins from the pituitary and the exogenous sex hormones administered.

Total lipids, in the birds receiving exogenous sex hormones, recorded an increase in concentration. The negative feed-back mechanism operating in the other two instances, phospholipid and cholesterol levels, does not seem to be operative in this case. The increased level of total lipids in pullets receiving sex hormones calls forth further investigation to elucidate the factors responsible for producing this condition.

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LIPID TRANSFER IN CHICKEN OVARY

BY

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ABSTRACT OF A THESIS

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ABSTRACT

The formation of an egg in the avian reproductive tract is a complex phenomenon. The exact mechanisms involved in the transfer of lipids synthesized in the liver and transported by blood to the ovary are not quite well understood. Hence this investigation was undertaken to study the various aspects of lipid transfer in relation to egg yolk formation.

Ten numbers each of clinically healthy White Leghorn female birds of five different age groups (50-54-days, 70-74-days, 100-104-days, 129-133-days and 223-227-days-old) were selected at random, for the study and reared under standard farm conditions. Another group of 40 White Leghorn pullets (100-104-days-old) were also selected at random and divided into four different groups of ten each. The first group of birds received stilbestrol dipropionate (SD), second group SD and progesterone (PG), the third group SD, PG, and testosterone dipropionate (TD) and the fourth group received olive oil alone for ten days consecutively. Blood serum, ovary and liver were collected from all the birds slaughtered by decapitation. Total lipid content in liver and ovary were determined by the method of Meynard and Joslyn (1970) and that in the serum , after extraction with ether and methyl alcohol. Phospholipid was estimated by adopting the method of King and Wootten (1959) and the total cholesterol by the method of Zak (1957).

The growing birds recorded a progressive increase in phospholipids in the ovary, liver and blood serum. But the pullets treated with exogenous sex hormones did not show any significant increase in the level of phospholipids in the ovary while that in the liver and blood serum were high. The cholesterol level in the ovary, liver and bloods serum were high. The cholesterol level in the ovary, liver and blood serum were high in the different growing birds. But, here also, the cholesterol content in the ovary did not reveal any significant increase in level in pullets treated with different combinations of hormones, but that in the serum and liver were elevated. However, in the case of total lipids, the ovary, liver and blood serum in the case of all categories of birds showed a significantly higher content as age advanced and on the administration of hormones.

The synthesis of lipids by the liver is increased in response to increasing levels of hormones as a result of growth and development of the birds. The lipids, synthesized in the liver, are distributed by the circulating blood to all the tissues, including the ovaries. The increase in concentration of lipids in the ovary as the birds grew older is due to the increased lipogenesis in the liver and their augmented transport by the blood. However, the pullets under the

influence of exogenous sex hormones exhibited a different response. In the case of phospholipids and cholesterol the ovarian levels were low while in the liver and serum the values were high. The low levels of these components in the ovary may be due to the lesser ovarian activity induced by the operation of the negative feed-back mechanism between the pituitary and the sex steroids administered. But this does not hold good in the case of total lipids in the ovary of pullets receiving sex hormones. Here the level was high as in the case of liver and serum indicating a total absence of the operation of the negative feed-back mechanism. This calls forth further studies to enlighten the phenomenon.