RESULTS

The effects of cholesterol (1g/100g diet), vitamin E (200mg/ Kg diet) and/or 50mg/ 100g of diet atorvastatin, simvastatin or lovastatin for five weeks on blood parameters, respiratory functions of blood, some serum metabolites, enzymes, hormones and electrolytes on laying hens, are presented in tables (1-9). Also the data obtained for some parameters in the eggs are presented in table (10).

Analysis of the variance (F-test) for all tested parameters of all groups; control group, fed on cholesterol (group I), fed on cholesterol and vitamin E (group II), fed on cholesterol and atorvastatin (group III), fed on cholesterol, vitamin E and atorvastatin (group IV), fed on cholesterol and simvastatin (group V), fed on cholesterol, vitamin E and simvastatin (group VI), fed on cholesterol and lovastatin (group VII), and fed on cholesterol, vitamin E and lovastatin (group VIII) showed significant difference ($P<0.001$) except that of mean corpuscular hemoglobin concentration (MCHC) which was significant ($P< 0.01$). Analysis of (t-test) for all tested parameters between each two groups were also carried out and presented in the tables (1-10).

Blood Parameters:-

Table (1) and Figs. (1-7) illustrate The effects of cholesterol (1g/100g diet), vitamin E (200mg/ Kg diet) and/or 50mg/ 100g of diet atorvastatin, simvastatin or lovastatin for five weeks

1- Leucocyte count (WBCs):

Leucocyte count value of control animal group was (19.70±0.13 $x10^3/mm^3$). The WBCs count value of group I was significantly high (P<0.001). While those of group II, and group IV were significantly high (P<0.01) and (P< 0.05) as compared to that of the control group, respectively. (Table 1 and Fig. 1).

The WBCs count value of group I was (23.40±0.87$x10^3/mm^3$) was significantly high (P<0.001) as compared to all treated groups.

The WBCs count value of group II (20.60±0.07$x10^3mm^3$) was significantly high (P<0.05) in relation to those of group III, group V, group VI and group VIII. While, it was significantly high (P< 0.01) as compared to that of group VII, and showed non significant increases (P > 0.05) in relation to that of group IV .

The WBCs count value of group III (19.90±0.21$x10^3/mm^3$) and group VII (19.18±0.11$x10^3/mm^3$) showed non significant decreases in relation to those of group IV and group VIII, respectively. While, group V (19.81±0.18$x10^3$ $/mm^3$) showed non significant increases as compared to that of group VI .

2- Erythrocyte count (RBCs):

In case of the control animal group RBCs count value was (2.85 ± 0.04 $x10^6/mm^3$). Group fed on cholesterol was significantly low (P<0.05) and group II, group III, group V, group VI and group VII were non significantly decreased. While group IV and group VIII showed non significant differences as compared to that of the control value (Table 1 and Fig. 2).

The RBCs count value of group I (2.71±0.02 $x10^6/mm^3$) was significantly low (P< 0.001) in relation to all treated groups.

The RBCs count value of group II (2.83±0.02 $x10^6/mm^3$), showed non significant difference as compared to group III, group IV, group VI and group VIII, while showed non significant increase as compared to that of group VII and showed non significant difference as compared to that of group V.

The RBCs count value of group III (2.84±0.02$x10^6/mm^3$). Group V (2.83±0.02 $x10^6/mm^3$). The RBCs count value of group VII was (2.82±0.01 $x10^6/mm^3$) showed non significant decreases in relation to those of group IV, group VI and group VIII, respectively .

3- Hemoglobin contents (Hb):

The Hb content of control animal group was (14.50±0.15 g/100ml). The (Hb) content value of group I was significantly low (P<0.001), while those of group II, group III, and group VI were significantly high (P<0.05) while, that of group VIII was significantly high (P<0.01) as compared to that of the control group (Table 1 and Fig. 3).

The Hb content value of group I (13.00±0.34 g/100ml) was significantly low (P<0.01) as compared to all treated groups.

The Hb content value of group II (14.70±0.14 g/100ml) showed non significant increases as compared to those of group IV, group V and group VII, while showed non significant decreases as compared to those of group III, gorup VI and group VIII.

Non significant difference between the Hb content value of group III (14.70±0.16 g/100ml) and that of group IV was observed. Also the Hb content value of group V (14.67±0.10 g/100ml) showed non significant decreases as compared to that of group VI, while the Hb content value of group VII (14.61±0.08 g/100ml) was significantly low ($P<0.05$) as compared to that of group VIII.

4- Hematocrit value (Hct):

The hematocrit value of control animal group was (45.40±0.30%). Group I was significantly low ($P<0.01$), while those of group II, group III, group IV, group VII and that of group V were significantly high ($P< 0.05$) and ($P<0.01$) in relation to that of the control group respectively. (Table 1 and Fig. 4).

The Hct value of group I (42.30±1.16 %) was significantly low ($P< 0.05$) and ($P<0.01$) as compared to the values of groups II, III, V and VII and those of groups IV, VI and VIII respectively.

The Hct value of group II (45.90±0.38 %) showed non significant increase as compared to those of group III, group IV, group VI, group VII, and group VIII. While, showed non significant decreases as compared to that of group V.

The Hct values of groups III, V and VII showed non significant increases as compared to those of groups IV, VI and VIII respectively.

5- Mean corpuscular volume (MCV):

The MCV value of control animal group was (159.10±1.07μ^3). The MCV values of group I, group II and group III were significantly high ($P<0.001$) in relation to that of the

control group, while those of group IV, group VI, group VII and group VIII were significantly high (P< 0.01) as compared to that of the control group (Table 1 and Fig. 5).

The MCV value of group I (165.70±1.80 μ^3) was significantly high (P< 0.001) as compared to those of group IV, group V, group VI, group VII, and group VIII, while it was significantly high (P< 0.01) as compared to both of group II, and group III.

The MCV value of group II (163±0.82 μ^3) was significantly high (P<0.001) as compared to, both of group IV and group V, while it was significantly high (P<0.01) as compared to both of group VI and group VIII. Also it was significantly high (P < 0.05) in relation to that of group VII, while it was non significantly increased as compared to that of group III.

The MCV value of group III (162.6±0.98 μ^3) and the MCV value of group VII (161.40±1.13 μ^3) showed non significant increases as compared to those of group IV and VIII. While, the MCV value of group V was (160±1.53) showed non significant decreases as compared to that of group VI, respectively.

6-Mean corpuscular hemoglobin (MCH):

The control animal group MCH value was (49.40±0.14 Pg). The MCH value of group I was significantly low (P<0.001), while group II were significantly higher (P<0.001) than that of the control group. While, those of group III, group IV, and that of group V were significantly high (P< 0.01) and (P < 0.05) respectively as compared to that of the control group, (Table 1 and Fig. 6).

The MCH value of group I (47.10±0.22 Pg) was significantly low (P< 0.001) in relation to all treated groups.

The MCH value of group II (49.90±0.80 Pg) was significantly high (P<0.01) as compared to those of group V, group VI, and group VIII, while it was significantly high (P<0.001) in relation to that of group VII. This value showed non significant increases as compared to both of group III and group IV.

The MCH values of group III (49.70±0.20 Pg), group V (49.54±0.10Pg) showed non significant decreases as compared to those of group IV and group VI, respectively. While, the MCH value of group VII was (49.58±0.09Pg) showed non significant increases as cmpared to that of group VIII respectively .

7- Mean corpuscular hemoglobin concentration (MCHC)

The MCHC value of control animal group was (30.64±0.10 %). The MCHC value of group I was significantly low (P < 0.001), while both of group II and group III were significantly higher (P<0.01) than that of the control group. Those of both group IV and group V were significantly high (P < 0.05) as compared to that of the control group (Table 1 and Fig. 7).

The MCHC value of group I (28.61±1.19%) was significantly low (P<0.001) in relation to all treated groups.

The MCHC value of group II (30.85±0.46 %) showed non significant increases in relation to those of group IV, group V, group VI, group VII, and group VIII.While, showed non significant decreases as compared to that of group III.

The MCHC values of group III, group V and group VII were (31.04±0.85%), (30.71±0.15%) and (30.66±0.11%) showed non significant increases as comapred to those of group IV, group VI and group VIII, respectively.

Respiratory Function of Blood

I- Blood gas parameters

Table (2) and figs. (8-10) illustrated the effects of cholesterol (1g/100g diet), vitamin E (200mg/ Kg diet) and/or (50mg/100g of diet) atorvastatin, simvastatin or lovastatin for five weeks on arterial and venous blood gas parameters of laying hens.

1- Blood oxygen partial pressure (PO_2):

The arterial and venous blood oxygen partial pressure (PO_2) values of the control animal group were (72.60± 10.40 mmHg) and (56.70±6.90 mmHg) respectively. The results presented in table (2) and fig. (8) showed that arterial blood oxygen partial pressure (P_aO_2) value of group I and group V were significantly low ($P<0.01$). Venous blood oxygen partial pressure (P_vO_2) value of group I, group III and group V showed significant decreases ($P < 0.01$), while those of group II, group VII and group VIII showed significant decreases ($P< 0.05$) as compare to that of the control group. (Table 2 and Fig. 8).

The arterial blood (P_aO_2) value of group I (62.10±10.20 mmHg) was significantly low ($P<0.01$) as compared to that of group IV, while it was significantly low ($P<0.05$) as compared to that of group II. It showed non significant decreases as compared to those of group III, group VI, group VII and group VIII. While, showed non significant increases as compared to group V. The (P_vO_2) value of group I (44.10±10.50mmHg) was significantly low ($P<0.05$) as compared to those of group II, group VI, group VII and group VIII, it was significantly low ($P<0.01$) in relation to that of

group IV. It was non significantly decreased as compared to both of group III and group V.

The (P_aO_2) value of group II (72.30±8.50 mmHg) was significantly high (P<0.01) as compared to that of group VII, while showed non significant increases as compared to those of group III, group V, group VI and group VIII. While, showed non significant decreases as cmpared to that of group IV. The (P_vO_2) value of group II was (48.50±3.60mmHg) showed non significant increases as compared to both of group III and group V. While, showed non significant decreases as compared to thoses of group IV, group VI, group VII and group VIII.

The (P_aO_2) value of group III (68.70±9.10 mmHg) was significantly low (P<0.05) in relation to that of group IV. The (P_vO_2) value of group III (46.60±4.60mmHg) was significantly low (P<0.01) as compared to that of group IV. The (P_aO_2) value of group V (61.90±13.90 mmHg) showed non significant decreases as compared to that of group VI. The (P_vO_2) value of group V (44.50±7.30mmHg) was significantly low (P<0.05) as compared to that of group VI. The (P_aO_2) of group VII (69.60±2.40 mmHg) was significantly low (P<0.05) as compared to that of group VIII. The (P_vO_2) value of group VII (49.00±4.90mmHg) showed non significant decreases as compared to that of group VIII.

2- Blood oxygen saturation (% O_2 sat):

The arterial and venous blood percentage oxygen saturation (% O_2 sat) values of the control animal were (95.70±1.80%) and 90.30±3.50%) respectively. The arterial blood % O_2 sat value of group V, and group VII showed significant decreases (P < 0.05), the

venous blood % O_2 sat value of group I, group III and group V, and those of group II and group VIII were significantly decreased ($P< 0.01$) and ($P<0.05$) as compared to that of the control group, respectively. (Table 2 and Fig. 9).

The arterial blood (%O_2 sat) value of group I (93.90±3.80%) showed non significant increases as compared to those of group III, group IV, group V, group VI, group VII, and group VIII. While, it showed non significant decreases as compared to both of group II and group IV. The venous blood (%O_2 sat) value of group I (72.90±13.30 %) was significantly low ($P<0.01$) as compared to both of group IV and group VII, while it was significantly low ($P<0.05$) in relation to those of group VI and group VIII. It showed non significant decreases as compared to those of group II, group III and group V.

The arterial blood (%O_2 sat) value of group II (94.30±3.70%) showed non significant increases as compared to those of group V, group VI, group VII, and group VIII. While showed non significant decreases as compared to that of group IV. The venous blood (%O_2 sat) value of group II (81.90±6.50 %) was significantly low ($P<0.05$) as compared to those of group IV and group VI, while it was significantly low ($P<0.01$) in relation to that of group VII and showed non significant increases as compared to those of group III, group V, and group VIII.

The arterial blood (%O_2 sat) value of group III (93.60±4.60%) showed non significant decreases in relation to that of group IV. The venous blood (%O_2 sat) value of group III was (81.1±6.7%) was significantly low ($P<0.05$) in relation to that of group IV. The

arterial blood (%O_2 sat) value of group V (91.70±3.70%) showed non significant decreases as compared to that of group VI. The venous blood (%O_2 sat) value of group V (80.30±7.90%) was significantly low (P<0.05) in relation to that of group VI. The arterial blood (%O_2 sat) values of group VII, was (92±2.10%) showed non significant decreases as compared to that of group VIII. The venous blood %O_2 sat value of group VII (90.10±2.10%) was significantly high (P< 0.01) as compared to that of group VIII.

3- Blood carbon dioxide partial pressure (PCO_2):

The arterial and venous blood carbon dioxide partial pressures (PCO_2) values of the control animal group were (25.80±2.50mmHg) and (29.30±5.1mmHg) respectively. There were a significant increases in arterial blood carbon dioxide (P_aCO_2) value of group I and those of group II and group III (P<0.01) and group VII was significantly decreased (P<0.01) in relation to that of the control group. Venous blood carbon dioxide partial pressure (P_vCO_2) value showed significant increases (P<0.001) in group I, (P< 0.01) in group II and (P<0.05) in group III and group V, group VI and group VIII while, (P_vCO_2) value of group VII was non significantly decreased as compared to that of the control group (Table 2 and Fig. 10).

The (P_aCO_2) value of group I (33.50±7.50mmHg) was significantly high (P<0.05) as compared to those of group IV, group VI and group VIII, and (P<0.01) in relation to that of group VII. It showed non significant increases as compared to those of group II, group III and group V. The (P_vCO_2) value of group I (43.70±9.60 mmHg) was significantly high (P<0.05) and (P<0.01) as compared

to both of group IV and group VII respectively. It showed non significant increases as compared to other treated groups.

The (P_aCO_2) value of group II (29.10±2.60 mmHg) was significantly high (P<0.05), (P<0.01) and (P<0.001) as compared to those of group IV, group VI, and group VII, respectively and showed non significant decreases as compared to that of group III. While, showed non significant increases as comapred to both of group V and group VIII. The venous blood (P_vCO_2) value of group II (39.50±8.90 mmHg) was significantly high (P< 0.05) in relation to that of group VII and showed non significant increases as compared to those of group III, group IV, group V, group VI, and group VIII.

Both the (P_aCO_2) and (P_vCO_2) values of group III (30.40±6.80 mmHg and 37.70±9.60 mmHg respectively) were non significantly decreased or increased as compared to that of group IV, respectively. The (P_aCO_2) value of group V was (27.10±5.80) showed non significant increases as compared to that of group VI. Also, the (P_vCO_2) value of group V, (36.60±9.20 mmHg) showed non significant increases as compared to that of group VI. The (P_aCO_2) value of group VII (21.10±2.40 mmHg) was significantly low (P<0.01) as compared to that of group VIII, while the (P_vCO_2) value of group VII (29.10±5.90 mmHg) showed non significant decreases as compared to that of group VIII (Table 2 and Fig. 10).

II- Blood acid-base status parameters:

Table (3) and Fig. (11-14) illustrate the effects of cholesterol (1g/100g diet), vitamin E (200mg/ Kg diet) and/or (50mg/100g of diet) atorvastatin, simvastatin or lovastatin for five weeks on arterial and venous blood acid-base status parameters of laying hens.

1- Blood pH:

The arterial and venous blood pH values of the control animal group were 7.34±0.03 and 7.31±0.05unit respectively. The data presented in Table (3) and Fig. (11) showed that the pH values of the arterial and venous blood of group I and group II were significantly low (P<0.01) while other treated groups showed non significant difference as compared to that of the control group.

The arterial and venous blood pH values of group I (7.21±0.09 and 7.20±0.10 unit respectively) were significantly low (P<0.05) in relation to other treated groups except group II which showed non significant increases as compared to that of group I.

Also, the arterial and venous blood pH values of group II (7.23±0.06 and 7.24±0.05 unit) were significantly low (P<0.01) in relation to those of group III, IV, V, VI and VII, except were significantly low (P<0.001) in arterial blood pH of group VIII.

The arterial and venous blood pH values of group III (7.31±0.10 and 7.30±0.10 unit respectively) showed non significant decreases in relation to that of group IV. Also, the arterial and venous blood pH values of group V (7.31±0.08 and 7.30 ± 0.10 unit respectively) showed non significant decreases in relation to that of group VI. The arterial and venous blood pH value of group VII showed non significant changes as compared to that of group VIII, (Table 8 and Fig.11).

2- Blood bicarbonate concentration (HCO^-_3):

The arterial and venous blood bicarbonate concentrations (HCO^-_3) values of the control animal group were (20.90±3.01mmol/1) and (19.50±4.80 mmol/1) respectively. The results presented in table (3) and fig. (12) showed arterial blood HCO^-_3 of group I was significantly increased ($P<0.05$), while venous blood (HCO^-_3) value concentration value of group I and group II were significantly increased ($P<0.01$) and ($P<0.05$) in relation to that of control group respectively.

The arterial blood HCO_3^- value of group I (24.30±3.60mmol/1) was significantly high ($p<0.05$), as compared to those of group II, group V, group VII and group VIII, while it showed non significant increases as compared to group III, group IV and group VI. The venous blood HCO^-_3 value of group I (24.40±2.10 mmol/1) was significantly high ($P<0.05$), and ($P<0.01$) in relation to that of group VI and both of group VII and group VIII respectively and showed non significant increases as compared to those of group II, group III, group IV and group V.

The arterial blood HCO^-_3 value of group II (19.90±1.80mmol/1) showed non significant decreases as compared to those of group III, group IV, group V, group VI and group VII. While showed non significant increses as compared to that of group VIII. The venous blood HCO_3^- value of group II (23.7±1.0mmol/1) was significantly high ($P<0.05$) as compared to those of group VII and group VIII, while showed non significant increases as compared to those of other treated groups.

The arterial and venous blood HCO_3^- values of group III, group V and group VII showed non significant differences as compared to those of group IV, group VI and group VIII respectively.

3- Blood total carbon dioxdie (TCO_2):

The arterial and venous blood total carbon dioxide (TCO_2) values of the control animal group were (21.60±3.00mmol/1) and (20.30±5.00mmol/l), respectively. Table (3) and Fig. (13) showed that arterial blood TCO_2 values of group I was significantly increased ($P<0.05$), while the venous blood TCO_2 of all treated groups were significantly increased ($P<0.05$) as compared to that of the control group .

The arterial blood TCO_2 value of group I (25.30±3.90 mmol/l) was significantly high ($P<0.05$) as compared to those of group II, III, V, VI, VII and VIII. It showed non significant increases as compared to that of group IV. The venous blood TCO_2 value of group I (25.70±2.70mmol/1) was significantly high ($P<0.05$) as compared to those group III, group V, group VI, group VII, group VIII. It showed non significant increases as compared to those of other treated groups.

The arterial and venous blood TCO_2 values of group II (21.80±1.70 and 24.50±2.20mmol/l) showed non significant difference as compared to those of group III, group IV, group V, group VI, group VII and group VIII.

The arterial and venous blood TCO_2 value of group III, group V and group VII showed non significant decreases as compared to

those of group IV, VI and VIII, respectively except, the venous blood TCO_2 value of group V showed non significant increases as comapred to that of group VI. (Table 3 and Fig. 13).

4- Blood base excess (BE):

The arterial and venous blood base excess (BE) values of the control animal group were -1.5±2.8mmol/1 and -1.7±3.3mmol/1 respectively. Arterial blood base excess (BE) value of group I showed significantly increased ($P<0.01$) while group II and group VI showed significantly decreased ($P<0.05$) and other treated groups showed non significant differences as compared to that of the control group. Venous blood base excess (BE) value of group I, group II, and group III, showed significant increases ($P<0.01$), while group V, and group VII showed significant increases ($P<0.001$), while that of group VIII were significantly increased ($P<0.05$) in relation to that of the control group. Venous blood (BE) value of group IV and group VI were non significantly changed in relation to the control group (Table 3 and Fig. 14).

The arterial blood BE value of group I (1.2±2.1mmol/l) was significantly high ($P<0.01$) as compared to that of group II. While, it showed significantly increased ($P<0.05$) as compared to those of group III, group V, group VI, group VII and group VIII, while it was non significantly increased as compared to that of group IV. The venous blood BE value of group I (-0.9±1.3mmol/l) was significantly high ($P<0.05$) as compared to those of group IV, VI and VIII, while showed significantly low ($P<0.01$) as compared to those of group V and group VII and showed non significant decreases as compared to both of group II and group III.

The arterial blood BE value of group II (-3.3±2.6mmol/1) showed non significant decreases in relation to those of other treated groups except, the arterial blood of group VI showed non signifcant decreases as compared to that of group II. The venous blood value BE of group II (0.90±2.80mmol/l) showed non significant decreases as compared to those of group III, group V and group VII, while showed non signifcant increases as compared to those of group IV, group VI and group VIII.

The arterial and venous blood BE values of group III and group V and VII were non significantly increased as compared to group IV, VI and VIII respectively (Table 3 and Fig. 14).

III- Blood oxygen equilibrium curve (OEC):

Table 4 and Figs. 15, 16, 17, 18 showed that OECs of all treated groups were shifted to the right, in relation to that of the control group. Blood oxygen half saturation pressure (P_{50} values) found to be (24 ± 0.3), (29 ± 0.1), (27 ±0.2) (26 ± 0.6) (25 ± 0.5), (27 ± 0.1), (25 ± 0.6), (25 ± 0.7) and (26 ± 0.8) in control group and groups I, II, III, IV, V, VI, VII and VIII, respectively the control curve and other curves interact and exchange their position in relation to each other (Table 4 and Figs. 15-18).

Serum Metabolites:

Table (5) and Figs. (19-28) represent serum metabolites, different lipids, proteins and glucose of cholesterol (1g/100g diet), vitamin E (200mg/ Kg diet) and/or (50mg/100g of diet) atorvastatin, simvastatin or lovastatin for five weeks of laying hens.

1- Serum total lipid concentration:

Serum total lipid concentration value of control animal group was 582.90±13.80(mg/dI). Total lipids of group I and group II showed significant increases (P<0.001 and P < 0.05) respectively, while, those of group III, group V and group VII were significantly increased (P<0.01), serum total lipids of gorup IV was non significantly decreased while, group VI and group VIII showed non significant increases as compared to that of the control group. (Table 5 and Fig. 19).

The serum total lipid concentration value of group I (635.70±13.90mg/dI) was significantly high (P<0.001) as compared to those of other treated groups.

Serum total lipid concentration value of group II (598.40±10.70mg/dI) was significantly low (P<0.01) as compared to that of group VII and showed non significant increases as compared to those of group IV, group VI and group VIII and showed non significant decreases as compared to thoses of group III, group V and group VII.

Serum total lipid consenctraiton value of group III (601.40±6.90mg/dI) was significantly high (P< 0.01) in relation to that of group IV. Also, the serum total lipids value of group V (602.90±7.60mg/dI) was significantly high (P< 0.01) as compared to that of group VI. While, serum total lipids of group VII (606.10±9.90mg/dI) was significantly high (P<0.05) as compared to that of group VIII (Table 5 and Fig. 19).

2- Serum total cholesterol concentration:

Serum cholesterol concentraiton value of control animal group was 182.0±19.80mg/dI table (5) and Fig. (20) showed that serum cholesterol concentraiton of group I, group V, group VII and group VIII were significantly increased ($P < 0.001$), while those of group II, group III, and group VI were significantly increased ($P<0.01$). While, group IV showed non significant increases in relation to that of the control group.

Serum cholesterol concentraiton value of group I (261.30±7.60mg/dI) was significantly high ($P<0.001$) as compared to those of group II, group III, group IV group V, group VI, group VII, and group VIII.

Serum cholesterol concentraiton value of group II, 228.60±13.10(mg/ dI) was significantly high ($P<0.01$) as compared to that of group IV and showed non significant increases as compared to those of group III, group V, group VI, group VII and group VIII.

Serum total cholesterol concentraiton values of groups III, showed significant increases ($P<0.01$) in relation to that of group IV. While, both of group V and VII were non significant differences as compared to those of VI and VIII, respectively. (Table 5 and Fig. 20).

3- Serum high density lipoprotein cholesterol concentration (HDL):

Serum high density lipoprotein cholesterol concentration (HDL) value of control animal group was 51.10±7.80(mg/dI). The (HDL) of group I, group V, group VII and group VIII showed significantly low ($P < 0.001$) in relation to that of the control group,

while those of group II, group III, and group VI were significantly low (P<0.01) and that of group IV showed non significant decreases as compared to that of the control group. (Table 5 and Fig. 21).

Serum HDL value of group I (24.10±3.40mg/dI) was significantly low (P< 0.001) as compared to those of group II, group III, group IV, group V, group VI, group VII and group VIII.

Serum HDL value of group II (37.00±5.10mg/dI), was significantly low (P< 0.01) as compared to that of group IV and showed non significant decreases as compared to those of group III, and group VI. While, it showed non significant increases as comapred to those of group V, group VII and group VIII.

Serum HDL value of group III group V and group VII showed non significant decreses as compared to those of group IV, group VI and group VIII, respectively. (Table 5 and Fig. 21).

4- Serum low density lipoprotein cholesterol concentration (LDL):

Serum low density lipoprotein cholesterol (LDL) concentration value of control animal group was (104.10± 6.30mg/dI). The (LDL) value of group I, and those of group II group V and group VII showed significant increases (P < 0.001) and (P<0.05) while those of groups III, IV, VI and VIII were non significantly incresed as compared to that of the control group respectively, (Table 5 and Fig. 22).

Serum LDL value of group I (169.60±12.30mg/dI) was significantly high (P< 0.001) in relation to those of other treated groups.

Serum LDL value of group II (114.90±8.50mg/dI) showed non significant increses as compared to those of group III, group IV, group V, group VI and group VIII. While, showed non significant decreases as compared to that of group VII.

Serum LDL value of group III, group V and group VII were non significantly increases as compared to those of group IV, group VI and group VIII respectively (Table 5 and Fig. 22).

5- Serum very low density lipoprotein cholesterol concentration (VLDL):

Serum very low density lipoprotein cholesterol concentration (VLDL) value of control animal group was (35.30±2.70mg/dI). The VLDL value of group I was significantly high (P<0.001) in relation to that of the control group, while those of group VI and group VIII showed significant decreases (P < 0.01) as compared to that of the control group. (Table 5 and Fig. 23).

Serum VLDL value of group I 57.40±7.70(mg/dI) was significantly high (P< 0.001) as compared to those of other treated groups.

Serum VLDL value of group II (33.50±3.50mg/dI) was significantly low (P< 0.05) as compared to that of group V. While, showed non significant decreases as compared to those of group III, group IV and group VII, and showed non significant increases as compared to those of group VI and group VIII.

Serum VLDL value of group III (36.60±3.90mg/dI) was non significantly increases as compared to that of group IV. Serum VLDL value of group V (37.90±3.40mg/dI) was significantly high (P< 0.01) in relation to that of group VI. Also, serum VLDL value

of group VII (37.60±5.50mg/dI) was significantly high (P< 0.01) as compared to that of group VIII.

6- Serum triglyceride concentration:

Serum triglyceride concentration value of control animal group was (172.70±13.00mg/dI). Serum triglyceride concentration value of group I and those of both group II and group VII showed significant increases (P < 0.001) and (P < 0.01) in relation to that of the control group, respectively. While, those of group III, group V and group VIII were significantly increased (P < 0.05) as compared to that of the control group. (Table 5 and Fig. 24).

Serum triglyceride level value of group I (246.30±6.90mg/dI) was significantly high (P< 0.001) as compared to those of group II, group III, group IV, group V, group VI, group VII, and group VIII.

Serum triglyceride level value of group II (192.90±8.90mg/dI) was significantly high (P< 0.05) as compared to those of group IV, group VI and group VIII and showed non significant increases as compared to those of group III, group V. While, showed non significant decreases in relation to group VII.

Serum triglyceride level value of group III (187.60±9.80mg/dI) and that of group V (189.40±9.50mg/dI) showed non significant increases as compared to both of group IV and group VI, respectively. Serum triglyceride level value of group VII (193.40±5.40mg/dI) was significantly high (P<0.05) as compared to that of group VIII.

7- Serum total protein contents:

Serum total protein content value of control animal group was (4.50±0.40g/dI). Serum total protein content value of group I was

significantly lower (P<0.001) than that of the control group, while those of both group IV and group VI showed significant decreases (P<0.05) as compared to that of the control group (Table 5 and Fig. 25).

Serum total protein content value of group I (2.80±0.30g/dI) was significantly low (P< 0.01) as compared to those of group II, III, V and VII, while group IV, VI and VIII were significantly low (P<0.05).

Serum total protein content value of group II (4.90±1.00g/dI) was significantly high (P< 0.05) in relation to group IV, group VI and group VIII and showed non significant increases in relation to those of group III, group V and group VII.

Serum total protein content value of group III (4.70±0.80g/dI) was significantly high (P< 0.05) as compared to that of group IV. Serum total protein of group V (4.80±1.00g/dI) was significantly high (P< 0.05) as compared to that of group VI. Serum total protein value of group VII (4.90±1.10g/dI) was significantly high (P<0.05) in relation to that of group VIII.

8- Serum albumin content:

Serum albumin content value of control animal group was (1.77±0.12g/dI). Serum albumin content value of group I was significantly low (P<0.001), while those of group II, group III, group V, group VI and group VII were significantly increased (P < 0.01) as compared to that of the control group. (Table 5 and Fig. 26).

Serum albumin content value of group I (1.36±0.84g/dI) was significantly low (P<0.001) in relation to that of group II, while was

significantly low (P< 0.05) as compared to both of group III and group IV, also was significant low (P<0.01) as compared to those of groups V, VI, VII and VIII.

Serum albumin content value of group II (2.75±0.53g/dI) was significantly high (P< 0.05) as compared to those of group IV, group VI and group VIII. While, it was non significantly changed as compared to those of group III, group V, group VI, group VII and group VIII.

Serum albumin content value of group III, group V and group VII showed significant increases (P<0.05) as compared to those of group IV, group VI and group VIII, respectively.

9- Serum globulin contents :

Serum globulin content value of control animal group was 2.61±0.02g/dI. Serum globulin content value of group I showed significant decreases (P<0.001), while serum globulin of group II, group III, group V, and that of group VII showed significant increases (P < 0.05) in relation to that of the control group. (Table 5 and Fig. 27).

Serum globulin content value of group I (2.40±0.09g/dI) was significantly low (P<0.01) as compared to those of group II and group III, group V, group VI, group VII and group VIII. While, it was significantly low (P< 0.05) as compared to that of group IV.

Serum globulin content value of group II (2.66±0.06g/dI) was significantly high (P<0.05) as compared to those of group IV, group VI and group VIII and showed non significant changes as compared to those of group III, group V, and group VII.

Serum globulin content value of group III was (2.64±0.06g/dI) showed significant increases (P<0.05) as compared to that of group IV. Also, serum globulin content value of group V (2.66±0.05g/dI) was significantly high (P< 0.05) as compared to that of group VI. While, serum globulin content value of group VII was 2.64±0.03(g/dI) showed non significant increases as compared to that of group VIII.

10- Serum glucose level:

Serum glucose level value of control animal group was (232.10±16.40mg/dI). Serum glucose level value of group I, group II, group III, and group V showed significant increases (P < 0.001), while those of group VI, group VII and group VIII were significantly increased (P < 0.01) as compared to that of the control group (Table 5and Fig. 28).

Serum glucose level value of group I (323.60±39.02mg/dI) was significantly high (P< 0.05) in relation to those of group IV, group VI and group VIII and showed non significant increases as compared to those of group II, group III, group IV and group VII.

Serum glucose level value of group II (291.00±26.80mg/dI) showed non significant increases in relation to those of other treated groups.

Serum glucose level value of group III (286.90±25.50mg/dI) was significantly high (P<0.05) in relation to that of group IV. Serum glucose level value of group V and group VII showed non significant increases as compared to those of group VI and group VIII respectively.

Serum Electrolytes

1- Serum sodium level (Na^+):

Serum sodium level value of the control animal group was (150.00±12.63mmol/1). Serum sodium level values of group II and group V and those of group IV, group VI and group VIII showed significant decreases ($P < 0.05$) and ($P < 0.01$) as compared to that of the control group respectively (Table 6 and Fig. 29).

Serum sodium level value of group I (151.00±13.71mmol/1) was significantly high ($P< 0.05$) as compared to those of group II, group IV, group VI and group VIII, while showed non significant increases as compared to those of group III, group V and group VII.

Serum sodium level value of group II (148.20±9.21mmol/1) was significantly high ($P<0.01$) as compared to that of group VI, while showed non significant increases as compared to those of group IV, group V and group VIII and non significant decrease as compared to both of gorup III and gorup VII.

Serum sodium level value of group III (149.00±13.82mmol/1) was significantly high ($P<0.01$) in relation to that of group IV. Serum sodium level value of group V, was(148.8±10.50mmol/1) showed significant increases ($P<0.01$) in relation to that of group VI. Also, serum sodium level value of group VII (150±4.6mmol/1) was significantly high ($P< 0.05$) as compared to that of group VIII.

2- Serum potassium level (K^+):

Serum potassium (K^+) level value of control animal group was 4.16± 0.58mmol/1. Serum potassium level value of group I, group V and group VII and both of group II and group III showed

significant decreases (P < 0.001) and (P < 0.05) as compared to that of the control group, respectively. (Table 6 and Fig. 30).

Serum potassium level value of group I (2.04±0.52mmol/1) was significantly low (P< 0.01) as compared to those of group II, group VI and group VIII and was significantly low (P<0.05) as compared to both of group III and group V. Also was significantly low (P< 0.001) as compared to that of to group IV, while showed non significant decreases as compared to that of group VII.

Serum potassium level value of group II (3.26±0.86mmol/1) was significantly low (P< 0.001) in relation to that of group IV, while showed non significant increases as compared to those of group III, group V and group VII. While, showed non significant decreases as compared to both of group VI and gorup VIII.

Serum potassium level value of group III (3.20±0.62mmol/1) was significantly low (P< 0.01) as compared to that of group IV. Serum potassium level value of group V (2.84±0.62mmol/1) showed significant decreases (P<0.01) as compared to that of group VI. Also, serum potassium level value of group VII (2.6±0.52mmol/1) was significantly low (P< 0.01) as compared to that of group VIII.

3- Serum calcium level (Ca^{++}):

Serum calcium (Ca^{++}) level value of the control animal group was 23.43±4.90mg/dI. Serum calcium level of group I was significantly decreased (P < 0.01) as compared to that of the control group (Table 6 and Fig. 31).

Serum calcium value of group I (13.47±5.20mg/dI) was significantly low (P< 0.05) as compared to those of group II, group

III, group V and group VII. Also, it was significantly low (P< 0.001) as compared to that of group IV, while was significantly low (P<0.01) in relation to both of group VI and group VIII.

Serum calcium level value of group II (21.36±5.1mg/dI) showed non significant increases in relation to those of group III, group V and group VII. While, showed non significant decrease as compared to those of gorup IV, groupVI and group VIII .

Serum calcium level values of group III, V and VII were non significantly decreased in relation to those of group IV, VI and VIII respectively.

4- Serum phosphorus level (P^{-4}):

Serum phosphorus (P^{-4}) level value of the control animal group was 7.89±0.88mmol/1. Serum phosphorus level values of group I, group V and group VII were significantly increased (P<0.001), while those of group II, group III, group VI and group VIII were significantly increased (P < 0.01) in relation to that of the control group. (Table 6 and Fig. 32).

Serum phosphorus level value of group I (15.77±0.75mmol/1), was significantly high (P<0.01) as compared to those of group II, group V and group VII. Also, was significantly high (P< 0.001) as compared to both of group III and group IV and it was significantly high (P< 0.05) in relation to both of group VI and group VIII.

Serum phosphorus level value of group II (12.57±1.32mmol) was significantly high (P<0.001) and (P<0.05) in relation to both of group IV and group VIII, respectively.

Serum phosphorus level value of group III (11.14±1.35mmol/1) was significantly high (P< 0.01) as compared to that of group IV. The serum phosphorus level value of group V (12.24±1.25mmol/1) showed non significant increases as compared to that of group VI. Serum phosphorus level value of group VII (13.29±1.39mmol/1) was significantly high (P< 0.01) as compared to that of group VIII.

Enzymes :

1- Serum aspartate amino transferase (AST) activity:

Serum aspartate amino transferase (AST) of control animal group was 267.10±0.79 U/ml. Serum Aspartate Amino transferase (AST) level value of group I, group III, group IV, group V, group VI, group VII and group VIII showed significant increases (P<0.001), as compared to that of the control group. (Table 7 and Fig. 33)

Serum AST level value of group I (271.4±1.88U/ml) was significantly high (P< 0.001) as compared to that of group II, while was significantly low (P< 0.001) as compared to those of group III, group V and group VII, while showed non significant increases as compared to those of group IV, group VI and group VIII.

Serum AST level value of group II (268.20 ±1.40U/ml) was significantly low (P< 0.001) as compared to those of group III, group V, group VII, while it was significantly low (P< 0.01) in relation to both of group VI and group VIII and was significantly low (P< 0.05) as compared to that of group IV.

Serum AST value of group III (275.70 ± 1.29U/ml) was significantly high (P< 0.001) as compared to that of group IV. Also, serum AST level value of group V (276.3±1.16U/ml) was also significantly high (P< 0.001) as compared to that of group VI. Serum AST level value of group VII (276.4±1.14U/ml) was significantly high (P< 0.01) as compared to that of group VIII (Table 7 and Fig. 33).

2- Serum alanine amino transferase (ALT) activity:

Serum alanine amino transferase (ALT) value of the control animal group was (41.64±0.44U/ml) serum alanine amino tranferase (ALT) level values of group I and group VI were significantly increased (P < 0.05) and (P < 0.01) respectively, while those of group III, group V, group VII, and group VIII showed significant increases (P < 0.001), in relation to that of the control group. (Table 7 and Fig. 34).

Serum ALT level value of group I (42.90±0.70U/ml) showed non significant increases in relation to those of group II, group IV, and group VI. It was significantly low (P< 0.001) as compared to those of group III, group V, group VII, and group VIII.

Serum ALT level value of group II (41.35±0.63) it was significantly low (P< 0.001) as compared to those of group III, group V, group VII and group VIII while it was significantly low (P < 0.001) in relation to that of group VI. It showed non significant decreases as compared to that of group IV .

Serum ALT level value of group III (43.74±0.77U/ml) was significantly high (P< 0.05) as compared to that of group IV. Also,

serum ALT level value of group V (45.09±1.03U/ml) was significantly high (P< 0.001) as compared to that of group VI. Serum ALT level value of group VII (45.76±1.25U/ml) was significantly high (P< 0.01), in relation to that of group VIII.

3-Hepatic microsomal 3-Hydroxy-3 Methylglutaryl-coenzyme A reductase (HMGR) activity:

Hepatic microsomal 3-Hydroxy-3 Methylglutaryl- coenzyme A reductase (HMGR) activity value of control animal group was (705±66.5Pmol/ min. mg protein). Group I was significantly decreased (P<0.00)1 and other treated group showed non significant increases in relation to that of the control group. (Table 7 and Fig. 35).

The (HMGR) activity value of group I (540±49.3Pmol/ min. mg protein) was significantly low (P< 0.001) as compared to those of group II, group III, group IV, group V, group VI, group VII and group VIII.

The (HMGR) activity value of group II (669±44.6Pmol/ min. mg protein) was significantly high (P< 0.001) as compared to those of group III , group V and group VII, while showed non significant decreases as compared to both of group IV and group VI and showed non significant increases as comapred to group VIII.

The (HMGR) activity values of group III and group V (664.30±44.70 and 660.90±37.40Pmol/ min. mg protein respectively) were significantly low (P<0.01) in relation to both of group IV and group VI respectively. Also, the (HMGR) activity of

group VII (661±36.8Pmol/ min. mg protein) was significantly low (P<0.001) as compared to that of group VIII.

Kidney Function :

1- Serum uric acid concentration:

Serum uric acid concentration value of control animal group was (3.30±1.30mg/dI). Serum uric acid concentration of group I and those of group II, group III, group V and group VII showed significant increases (P<0.001) and (P < 0.05) as compared to that of the control group, respectively. (Table 8 and Fig. 36).

Serum uric acid concentration value of group I (7.01±1.07mg/dI) was significantly high (P< 0.001) as compared to those of group II, group III, group IV, group V, group VI, group VII and group VIII.

Serum uric acid concentration value of group II (4.9±0.5mg/dI) was significantly high (P< 0.001) and (P<0.01) as compared to that of group IV and those of group VI and group VIII respectively. It showed non significant increases as compared to those of group III, group V and group VII.

Serum uric acid concentration value of group III (4.60±0.50mg/dI) was significantly high (P< 0.001) as compared to that of group IV. Serum uric acid concentration value of group V (4.70±0.50mg/dI) was significantly high (P< 0.01) as compared to that of group VI. Also, serum uric acid concentration value of group VII (4.90±0.60mg/dI) was significantly high (P< 0.001) in relation to that of group VIII.

2- Serum creatinine concentration:

Serum creatinine concentration value of the control animal group was 1.06±0.26(mg/dI). Serum creatinin consentration value of group I was significantly higher (P <0.001) than that of the control group. Serum creatinine constration of group III, group V and group VII were significantly decreases (P < 0.05) and those of group IV, group VI and group VIII were significantly decreased (P < 0.01) in relation to that of the control group. (Table 8and Fig. 37).

Serum creatinine concentraiton value of group I (1.77±0.18mg/dI) was significantly high (P< 0.001) in relation to those of group II, group III, group IV, group V, group VI, group VII, and group VIII.

Serum creatinine concentration value of group II (0.70±0.39mg/dI) showed non significant increases as compared to those of group III, group IV, group V, group VI, group VII and group VIII.

Serum creatinine concentraiton values of group III, V and VII were non significantly increased as compared to those of group IV, VI and VIII respectively (Table 8 and Fig. 37).

Hromones:

1- Serum progesterone level:

Serum progesterone level value of control animal group was 1.69±0.76ng/dI. Serum progesterone level values of group I, group II and that of group III showed significant increases (P<0.001) and

(P< 0.01) respectively, while those of group IV, group V and group VI were significantly increased (P<0.05) in relation to that of the control group. (Table 9 and Fig. 38).

Serum progesterone level value of group I (3.81±0.32ng/dI) was significantly high (P<0.01) as compared to those of group II, III and IV and (P< 0.001) as compared to those of group V, group VI, group VII and group VIII.

Serum progesterone level value of group II (3.49±0.23ng/dI) was significantly high (P< 0.001) as compared to those of group III, group IV, group V, group VI, group VII and group VIII.

Serum progesterone level value of group III, group V and group VII showed non significant increases as compared to those of group IV, group VI and group VIII, respectively.

2- Serum esterogene level:

Serum esterogene level of control animal group was 210.00±27.10 Pg/ml. Serum value esterogene level value of group I and group II were significantly increased (P<0.01), while other treated groups showed non significant difference as compared to that of the control group. (Table 9 and Fig. 39).

Serum esterogene level value of group I (234.3±23.7Pg/ml) was significantly high (P< 0.05) as compared to those of group III, group IV, group V, group VI and group VII, while was significantly high (P<0.01) in relation to that of group VIII. It was non significantly high as compared to that of group II.

Serum esterogene level value of group II (230.70 ± 22.07Pg/ml) was significantly high (P< 0.05) as compared to that of group VI, while showed non significant increases as compared to those of group III, group IV, group V, group VII and group VIII.

Serum esterogene level values of group III and group IV (213.30±27.20Pg/ml and 215±16.6Pg/ml respectively) showed non significant difference between them. Also, serum esterogen levels of group V and group VI (208.6±28.7Pg/ml and 206.60±12.40Pg/ml respectively) showed non significant difference between them. Serum esterogene levels of group VII and group VIII (204.60±39.70Pg/ml and 201.60±13.90Pg/ml respectively), showed non significant difference between them.

Egg Parameters:

1- Egg weight

Egg weight value of control animal group was 64.60±0.20g. Egg weight value of group I and those of both group II and group VII showed significant increases (P < 0.001) and (P < 0.05) respectively, while group III and group V showed non significant increases and those of group IV, group VI and group VIII showed non significant decreases in relation to that of the control group. (Table 10 and Fig. 40).

The egg weight value of group I (68.69±1.85g) was significantly high (P< 0.001) as compared to those of group IV, group VI and group VIII, while was significantly high (P< 0.01) in relation to both of group III and group V and was significantly high

(P< 0.05) as compared to that of group II and showed non significant changes in relation to that of group VII.

The egg weight value of group II (66.29±1.52g) was significantly high (P<0.001) as compared to that of group IV, while was significantly high (P<0.01) in relation to that of group VI and showed non significant increases as compared to those of group III, group V, group VII and showed non significant decreases as compared to that of group VIII.

The egg weight value of group III was 65.03±1.27(g) showed non significant increases as compared to that of group IV. Also, the egg weight value of group V (65.57±1.67g) was significantly high (P< 0.05) as compared to that of group VI. The egg weight value of group VII (66.71±1.85g) showed non significant increases in relation to that of group VIII.

2- Egg yolk weight:

Egg yolk weight value of control animal group was 17±0.36g. Egg yolk weight value of group I, group II, group V, group VI and group VII showed significant increases (P<0.001), while those of group III and group IV showed non significant increases and group VIII showed significant increases (P<0.01) as compared to that of the control group, respectively. (Table 10 and Fig. 41).

Yolk weight value of group I (19.97±0.3g) was significantly high (P<0.01) as compared to that of group IV and was significantly high (P<0.05) in relation to those of group III, group VI and group VIII, while showed non significant increases as compared to that of group II. While, showed non significant decreases as compared to

both of group V and group VII. Yolk weight of group II was (19.6±0.77g) showed non significant changes as compared to those of group III, group IV, group V, group VI, group VII and group VIII. Yolk weights value of group V, and group VII were significantly high (P< 0.05) as compared to both of group VI and group VIII respectively (Table 10 and Fig. 41).

3- Egg albumin weight

Egg albumin weight value of control animal group was 38.10±1.10g. Egg albumin weight value of group I was significantly higher (P<0.01) than that of the control group, while those of group IV, group VI, group VII and group VIII were significantly lower (P< 0.001) than that of the control group. (Table 10 and Fig. 42).

Egg albumin weight value of group I (42.07±2.80g) was significantly high (P< 0.001) as compared to those of group IV, group VI and group VIII, while was significantly high (P< 0.01) as compared to those of group II, group III and group V and was significantly high (P<0.05) as compared to that of group VII.

Albumin weight value of group II (36.63±2.30g) was significantly high (P< 0.01) as compared to that of group IV and showed non significant increases as compared to those of group III, group VI and group VIII. While, showed non significant decreases as compared to both of group V and group VII.

The egg albumin weights value of group III and group V were non significantly increased from both of group IV and group VI respectively. While, albumin weight value of group VII

(38.33±2.9g) was significantly high (P< 0.05) in relation to that of group VIII.

4- Egg shell weight:

Egg shell weight value of control animal group was (9.51±0.71g). which was significantly high (P< 0.01) and (P< 0.05) as compared to that of group I, and both of group V and group VII respectively, while it was significantly low (P< 0.01), (P< 0.001) and (P< 0.05) as compared to those of group III and group IV and those of both group VI and group VIII, respectively. It showed non significant decreases as compared to that of group II (Table 10 and Fig. 43).

The egg shell weight value of group I (6.65±0.27g) was significantly low (P< 0.01) in relation to those of group II, V, VI, VII and group VIII, while it was significantly low (P< 0.001) as compared to both of group III and group IV.

Egg shell weight value of group II was (9.77±0.2g) was significantly low (P<0.05) and (P<0.001) in relation to those of group III, group VI, group VIII and that of group IV, respectively. While it was significantly high (P<0.05) as compared to those of group V and group VII.

The egg shell weight value of group III and group V and that of group VII were significantly low (P<0.05) and (P<0.01) as compared to both of group IV and group VI, and that of group VIII, respectively.

5- Egg shell weight ratio (%):

Percent egg shell weight of control animal group was 14.7±1.34(%). Percentage egg shell weight (% shell weight) value of group I, and both of group V, group VII were significantly lower (P<0.001) and (P<0.05), than that of the control group, respectively. Percentage shell weight of group IV and those of group III and group VI showed significant increases (P<0.001) and (P<0.01) as compared to that of the control group respectively (Table 10 and Fig. 44).

Egg shell weight ratio (%) of group I (9.60±0.85%) was significantly low (P< 0.001) at as compared to those of group II, group III, group IV, group V, group VI and group VIII, while it was significantly low (P< 0.01) as compared to that of group VII.

The egg shell weight ratio of group II (14.70±3.22%) was significantly low (P< 0.001) as compared to that of group IV, while was significantly low (P< 0.05) in relation to both of group III and group VIII and was significantly high (P<0.05) as compared to both of group V and group VII and showed non significant decreases as compared to that of group VI.

The egg shell weight ratio value of group III (16.20±1.32%) was significantly low (P< 0.001) as compared to that of group IV. Also, egg shell weight ratio value of group V (13.20±1.25%), was significantly low (P<0.01) as compared to that of group VI. Egg shell weight ratio value of group VII (12.5±1.41%) was significantly low (P<0.001) as compared to that of group VIII (Table 10 and Fig. 44).

6- Egg yolk cholesterol concentration:

Egg yolk cholesterol concentration value of control animal group was (11.63±0.1mg/g yolk). Yolk cholesterol concentration value of group I, group VII and group VIII showed significant increases ($P<0.001$). While, those of group II, group III and group VI were significantly increased ($P < 0.05$) and that of group V was significantly increased ($P< 0.01$) in relation to that of the control group. (Table 10 and Fig. 45).

Egg yolk cholesterol value of group I (16.67±1.8mg/g yolk) was significantly high ($P<0.001$) as compared to those of group IV, group VI and group VIII, while was significantly high ($P< 0.01$) as compared to that of group III and was significantly high ($P< 0.05$) in relation to both of group II and group V.

Egg yolk cholesterol concentraiton of group II (13.76±1.88mg/g yolk) was significantly high ($P<0.05$) as compared to that of group IV and showed non significant increases as compared to those of group III, group VI and group VIII. While, showed non significant decreases as comapred to both of group V and group VII.

Egg yolk cholesterol concentraiton value of group III (13.17±1.55mg/g yolk) was significantly high ($P<0.001$) as compared to that of group IV. While, egg yolk cholesterol consentraiton value of group V (14.54±1.96mg/g yolk) and that of group VII (15.37±2.06mg/g yolk) showed non significant differences as compared to those of group VI and group VIII respectively (Table 10 and Fig. 45).

7- Egg yolk calcium concentration :

Calcium concentration value of egg yolk of control animal group was (1.30±0.08mg/g yolk). Calcium concentration value of egg yolk of group II, group III, group IV, group VI and group VIII showed significant increases ($P < 0.001$), while that of group I and that of group V were significantly increased ($P < 0.01$) and ($P < 0.05$) in relation to that of the control group, respectively (Table 10 and Fig. 46).

Calcium of egg yolk concentration value of group I (1.49±0.13mg/g yolk) was significantly low ($P< 0.01$) as compared to that of group IV, while showed non significant increases as compared to those of group V and group VII. While showed non significant decreases as compared thos of group II, group III, group VI and group VIII.

Calcium of egg yolk concentration value of group II (1.61±0.13mg/g yolk) was significantly high ($P<0.05$) and ($P<0.01$) as compared to both of group V and group VII, respectively.

Calcium of egg yolk concentration value of group III (1.53±0.11mg/g yolk) was significantly low ($P< 0.05$) in relation to that of group IV. Also, calcium of egg yolk concentration value of group V (1.44±0.1mg/g yolk) and that of group VII (1.39±0.11mg/g yolk) were significantly low ($P<0.01$) as compared to those of group VI and group VIII respectively (Table 10 and Fig. 46).

8- Egg yolk phosphorus concentration :

Phosphorus concentration vlue of egg yolk of control animal group was (4.90±0.57mg/g yolk). Phosphorus concentration value

of egg yolk of group I, group II, group III, group IV, group VI and group VIII showed significant increases (P<0.001) in relation to that of the control group. Phosphorus concentration value of egg yolk of group VII showed non significant decreases as compared to that of the control group. (Table 10 and Fig. 47).

Phosphorus concentration value of egg yolk of group I (5.9±1.15mg/g yolk) was significantly low (P< 0.001) as compared to that of group II. While, was significantly low (P< 0.01) in relation to those of group III, group IV, group VI and group VIII, while was significantly high (P< 0.01) in relation to those of group V and group VII.

Phosphorus concentration value of egg yolk of group II (6.60±0.87mg/g yolk) was significantly high (P<0.001) as compared to those of group III, group V and group VII, while showed non significant decreases as compared to those of group IV, group VI. While, showed non significant increases as comapred to that of group VIII.

Phosphorus concentration egg yolk of group III (6.10±1.20(mg/g yolk) was significantly low (P< 0.05) in relation to that of group IV. Also, phosphorus concentration value of egg yolk of group V (4.8±0.61(mg/g yolk) was significantly low (P< 0.001) in relation to that of group VI. Phosphorus concentration value of egg yolk concentration of group VII (4.81±0.41mg/g yolk) was significantly high (P<0.001) as compared to that of group VIII (Table 10 and Fig. 47).