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# CLINICOPATHOLOGICAL STUDY ON THE EFFECT OF BETA-GLUCAN ON HEMATOLOGICAL AND IMMUNOLOGICAL AND BIOCHEMICAL CHANGES IN BROILER CHICKS

**Salim, H.A.**[a], **Abd-Allah, O. A.**[b], **and Fararh, K.M.**[a]

[a] *Clinical pathology department, Faculty of Veterinary Medicine, Benha University,* [b]*Clinical pathology department, Faculty of Veterinary Medicine, Suez Canal University, Egypt.*

## A B S T R A C T

The present study was conducted on "Hubbard breeds" broilers to evaluate the effect of feeding prebiotic (Beta-glucan) on leukocytes, some biochemical blood parameters and immune response in normal and Salmonella infected chicks. Eighty, one day old broiler chicks were randomly divided into four equal groups as follow: control group, prebiotic fed group (NPRE), infected group with *Salmonella typhimurium* non-treated (INT) and infected treated group (IPRE). Beta-glucan was used as Prebiotic. Results of prebiotic supplementation revealed significant leukocytosis and lymphocytosis, hyperprotinemia, hyperglobinemia, and significant decrease in triglycerides, total cholesterol, and glucose concentration with no significant change in the values of AST, ALT, uric acid and creatinine concentration, also significant increase in HI titer, phagocytic activity and phagocytic index were observed. On the other hand, infection with *Salmonella typhimurium* showed leukocytosis, heterophilia and lymphopenia, hypoproteinemia, hypoalbuminemia, elevation of liver enzymes activities (AST and ALT), uric acid, and creatinine concentration, which indicate liver and kidney damage. Immunological parameters revealed increase in serum alpha and beta globulins, and significant decrease in Phagocytic activity and Phagocytic index. In IPRE group results showed decreased elevated liver enzymes, uric acid and creatinine, as well as increase the reduction in protein, albumin, HI titer, phagocytic activity and phagocytic index. From the obtained results it could be concluded that prebiotic Beta Polo (Beta-glucan) had clear impact in increasing leukocyte and immune response, which appeared to reduce the severity of *Salmonella typhimurium* infection, serum lipids and improvement of hepato-renal functions**.**

**KEY WORDS**: Beta-glucan, Broiler, Prebiotic

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## 1. I N T R O D U C T I O N

Prebiotic is a non-viable food component that confers a health benefit on the host associated with modulation of the microbiota [12].Beta-glucan, which is derived from the cell wall of yeast, bacteria and fungi etc., is a known immuno-modulator in pigs, poultry and some marine animals [16]. Also, Beta-glucan acts by binding and removing pathogens from the intestinal tract and stimulation of the immune system in broiler chicks [28]. Moreover, Beta-glucan also controls growth of entero-pathogenic bacteria [21]. The present study was, therefore, undertaken to determine the effect of dietary prebiotic (beta-glucan) supplementation on leukocytes, some biochemical blood parameters and immune response in normal and Salmonella infected broilers.

## 2. MATERIALS AND METHODS

2.1. *Birds*:

Eighty broiler chicks (Hubbred breed) one day old were used in this study. Birds were randomly divided into four equal groups, each one contained 20 birds. All birds were subjected to the ordinary vaccination program for broilers against New castle and Gumboro diseases. All birds were fed balanced commercial starter and growing rations (21% and 18% protein, respectively) and fresh and clean drinking water was fed ad-libtium. The birds were housed in floor – pen (0.1 $m^2$ / bird), in clean well ventilated separate experimental rooms throughout the period of experiment.

2.2. *Prebiotic*: Beta Polo (beta-glucan)

One liter of prebiotic (Beta Polo®, DMJ Biotech Co., South Korea) contains β 1, 3-glucan (30.000mg), propylene glycol (1.000 mg) and purified water up to 1000 ml. It is used at a dose 1ml/1liter of drinking water

2.3. *Experimental design:*

The current work was conducted on eighty broiler chicks; one day old for 42 days. Birds were divided into 4 equal groups: Control Group; non-treated normal chicks, NPRE Group (prebiotic group); normal chicks treated with beta-glucan, INT Group (*Salmonella typhimurium* infected group); infected but non-treated chicks and finally IPRE Group (infected treated group); infected chicks and treated with beta-glucan.
Chicks of INT and IPRE groups were infected orally with 0.1 ml saline contained $9\times10^8$ CFU *Salmonella typhimurium* at the $10^{th}$ day of age.

2.4. *Blood samples*

Blood was collected from wing vein (cutaneous brachial vein) from 10 birds at 14, 28 and 42 days of age and divided as follow:

*EDTA blood*: Blood was collected in clean dry bottle containing dipotassium salt of EDTA as anticoagulant in concentration of 2mg/1ml of blood [5] and used for hematological studies.

*Serum*: blood was collected in plain clean well-dried centrifuge tube and used for separation of serum to be used in estimation of biochemical parameters and serological studies.

*Heparinized blood*: blood was collected on heparin (20 IU/ml) and was used for separation of leukocyte for measurement of phagocytic activity.

2.5. *Hematological examination*:

Determination of total and differential leukocyte count was made according to the method described by Bourdon et al. [3].

2.6. *Biochemical parameters*:

2.6.1. Determination of serum total protein level: It was determined using commercial kits (Pasteur, Lab) according to Finley et al. [8].

2.6.2. Determination of serum albumin level: It was determined by colorimetrically [6].

2.6.3. Determination of serum globulin: Total globulin calculated according to the equation [6]:

Globulin = Total protein–Albumin.

2.6.4. Determination of Albumin/ Globulin ratio (A/G ratio) was determined by dividing serum albumin value on serum globulin value according to the method implied by Domuas et al. [7].

2.6.5. Determination of Aspartate amino transferase and Alanine amino transferase activities (AST and ALT) as described by Richmond [24].

2.6.6. Determination of serum triglycerides was estimated by the method described by Wood [30].

2.6.7. Serum cholesterol was estimated by the method according to Shareef and Al-Dabbagh [25].

2.6.8. Determination of serum HDL was performed according to Friedewalad et al. [9].

2.6.9. Serum LDL was calculated mathematically according to equation described by EL-Boshy et al. [10] as follows:
LDL = Total cholesterol – HDL –TG/5.

2.6.10. Determination of serum VLDL calculated mathematically according to equation described by EL-Boshy et al. [10] as the follows: VLDL=TG/5

2.6.11. Glucose concentration was determined by enzymatic-colourimeteric method according to Wahlefeld [29].

2.6.12. Serum uric acid was determined according to the method of Caraway (1963).

2.6.13. Determination of serum creatinine was performed according to the method of Coles [6].

2.7. *Immunological study*

2.7.1. Serum protein electrophoresis:
It was performed according to the method described by Markovicva et al. [20].

2.7.2. Estimation of humeral immunity:
It was performed by using haemagglutination inhibition (HI) test against ND using the standard microplate system as described by Laemmli [19].
2.7.3. Phagocytic activity and phagocytic index: It was determined according to Khosravi et al. [17].

2.8. *Statistical analysis*

The obtained data was compared across groups using analysis of variance (ANOVA). Data was expressed as mean (±S.E.). Level of significance of $P<0.05$ was chosen to identify the significant differences [27].

## 3. RESULTS

*Mortality rate*:
There was no mortality reported in beta-glucan fed group, on the other hand, infected non treated group mortality rate reach30 %(6/20), while in infected treated group mortality reduce to 15% (3/20).

*Leukogram*:
A significant increase in total leukocyte and lymphocytes count (leukocytosis and lymphocytosis) were observed in NPRE group without change in heterophils count when compared with the normal control group. Also, a significant increase in total leukocyte count and heterophils count (heterophilia) and decrease in lymphocytes count (lymphopenia) were observed in INT group as compared to the control one. On the other hand, there was significant increase in lymphocyte count and significant decrease in heterophils count in IPRE group compared to INT group (Table, 1).

*Serum total protein, albumin, globulins and A/G ratio*:
The obtained data (table 2) revealed that there was significant increase in serum total protein and globulins and significant decrease in A/G ratio without change in albumin concentration in NPRE group when compared to control. There was significant decrease in serum total protein, albumin concentration and A/G ratio and significant increase in total globulins level of INT group compared to control group.

Table 1 Leukogram in different groups

| Group | Age | WBCS ($10^3$/µl) | Lymphocytes ($10^3$/µl) | Heterophils ($10^3$/µl) | Monocytes ($10^3$/µl) | Eosinophil ($10^3$/µl) | Basophils ($10^3$/µl) |
|---|---|---|---|---|---|---|---|
| control | 14 | 22.2 ± 0.58[a] | 11.67 ± 0.32[a] | 7.63 ± 0.2[a] | 1.90 ± 0.16[a] | 0.17 ± 0.08[a] | 0.81± 0.17[a] |
| | 28 | 22.2 ± 0.85[a] | 11.82 ± 0.27[a] | 7.34 ± 0.76[a] | 1.80 ± 0.1[a] | 0.52 ± 0.05[a] | 0.70 ± 0.08[a] |
| | 42 | 22.2 ± 37[a] | 11.57 ± 0.24[a] | 7.58 ± 0.52[a] | 2.02 ± 0.1[a] | 0.88 ± 0.18[a] | 0.13 ± 0.06[a] |
| NPRO | 14 | 25.2 ± 0.58[b] | 13.49 ± 0.37[b] | 8.97 ± 0.66[a] | 1.8 ± 0.12[a] | 0.13 ± 0.05[a] | 0.79 ± 0.1[a] |
| | 28 | 25.2 ± 37[b] | 13.89 ± 0.23[b] | 7.89 ± 0.43[a] | 1.90 ± 0.09[a] | 0.68-0.08[a] | 0.82 ± 0.06[a] |
| | 42 | 25.6 ± 0.87[b] | 13.33 ± 0.35[b] | 9.45 ± 0.36[a] | 1.83 ± 0.07[a] | 0.79-0.17[a] | 0.17 ± 0.09[a] |
| INT | 14 | 24.4 ± 0.51[c] | 8.78 ± 0.2[c] | 13.45 ± 0.36[b] | 1.37 ± 0.1[b] | 0.18 ± 0.01[a] | 0.61 ± 0.07[a] |
| | 28 | 24.6 ± 0.99[c] | 10.17 ± 0.16[c] | 11.40 ± 0.88[b] | 1.84 ± 0.05[a] | 0.45 ± 0.04[a] | 0.71 ± 0.05a |
| | 42 | 25.6 ± 0.81[c] | 9.10 ± 0.09[c] | 13.26 ± 0.7[b] | 1.88 ± 0.08[a] | 0.71 ± 0.1[a] | 0.21 ± 0.07[a] |
| IPRO | 14 | 24.4 ± 1.08[c] | 10.10 ± 0.09[a] | 11.46 ± 0.11[b] | 1.76 ± 0.1[c] | 0.12 ± 0.05[a] | 0.95 ± 0.09[a] |
| | 28 | 25 ± 0.71[c] | 11.29 ± 0.38[a] | 10.71 ± 0.66[b] | 1.84 ± 0.02[a] | 0.31 ± 0.04[a] | 0.83 ± 0.0[3] |
| | 42 | 24.6 ± 0.93c | 10.95 ± 0.24[a] | 10.57 ± 1.11[c] | 1.82 ± 0.15[a] | 1.05 ± 0.15[a] | 0.18 ± 0.09[a] |

Means (± S.E) with different superscript (a,b,c,d) within the same column are significantly different at $p<0.05$.

Table 2 Serum biochemical parameters in different groups

| Group | Age | T. Protein (g/dl) | Albumin (g/dl) | globulins (g/dl) | A/G ratio |
|---|---|---|---|---|---|
| Control | 14 | 4.7 ± 0.03[a] | 2.22 ± 0.06[a] | 2.48 ± 0.02[a] | 0.90 ± 0.05[a] |
| | 28 | 4.62 ± 0.06[a] | 2.18 ± 0.06[a] | 2.44 ± 0.07[a] | 0.89 ± 0.05[a] |
| | 42 | 4.66 ± 0.12[a] | 2.04 ± 0.02[a] | 2.62 ± 0.12[a] | 0.78 ± 0.04[a] |
| NPRO | 14 | 4.92 ± 0.05[b] | 2.08 ± 0.07[a] | 2.84 ± 0.05[b] | 0.73 ± 0.04[b] |
| | 28 | 4.98 ± 0.04[b] | 2.0 ± 0.04[a] | 2.98 ± 0.02[b] | 0.67 ± 0.02[b] |
| | 42 | 4.94 ± 0.05[b] | 1.92 ± 0.04[a] | 3.02 ± 0.02[b] | 0.63 ± 0.01[b] |
| INT | 14 | 4.16 ± 0.05[c] | 1.36 ± 0.04[b] | 2.8 ± 0.04[b] | 0.48 ± 0.02[b] |
| | 28 | 4.18 ± 0.05[c] | 1.32 ± 0.04[b] | 2.86 ± 0.07[b] | 0.48 ± 0.02[b] |
| | 42 | 4.22 ± 0.09[c] | 1.34 ± 0.05[b] | 2.88 ± 0.11[b] | 0.47 ± 0.04[b] |
| IPRO | 14 | 4.42 ± 0.09[d] | 1.56 ± 0.05[c] | 2.86 ± 0.15[b] | 0.54 ± 0.03[b] |
| | 28 | 4.5 ± 0.11[d] | 1.7 ± 0.05[c] | 2.8 ± 0.17[b] | 0.62 ± 0.06[b] |
| | 42 | 4.55 ± 0.11[d] | 1.62 ± 0.06[c] | 2.94 ± 0.14[b] | 0.55 ± 0.04[b] |

Means (± S.E) with different superscript (a,b,c,d) within the same column are significantly different at $p<0.05$.

Table 3 Serum biochemical parameters in different groups

| Group | Age | AST (U/L) | ALT (U/L) | Uric Acid mg/dl) | Creatinine (mg/dl) | Glucose (mg/dl) |
|---|---|---|---|---|---|---|
| Control | 14 | 63.0 ± 071[a] | 68.0 ± 0.23[a] | 2.0 ± 0.32[a] | 1.22 ± 0.04[a] | 83 ± 0.63[a] |
| | 28 | 64.2 ± 0.58[a] | 69.6 ± 0.68[a] | 1.8 ± 0.2[a] | 1.12 ± 0.04 | 84.0 ± 0.45[a] |
| | 42 | 65.0 ± 0.32[a] | 68.4 ± 0.51[a] | 1.8 ± 0.24[a] | 1.14 ± 0.04[a] | 80.8 ± 0.58[a] |
| NPRO | 14 | 62.8 ± 0.66[a] | 68.0 ± 0.95[a] | 2.0 ± 0.32[a] | 1.2 ± 0.07[a] | 78.0 ± 0.55[b] |
| | 28 | 64.4 ± 0.51[a] | 70.2 ± 0.[86a] | 1.8 ± 0.37 | 1.08 ± 0.05[a] | 80.0 ± 0.45[b] |
| | 42 | 64.6 ± 0.93[a] | 67.8 ± 0.8[a] | 2.0 ± 0.32[a] | 1.14 ± 0.05[a] | 76.8 ± 0.58[b] |
| INT | 14 | 66.0 ± 0.23[b] | 74.0 ± 0.32[b] | 3.4 ± 0.24[b] | 1.46 ± 0.05[b] | 81.6 ± 0.68[b] |
| | 28 | 68.6 ± 0.5[b] | 74.8 ± 0.58[b] | 3.4 ± 0.24[b] | 1.38 ± 0.04[b] | 82.0 ± 0.68[c] |
| | 42 | 68.2 ± 0.37[b] | 71.2 ± 0.73[b] | 2.8 ± 0.37[b] | 1.46 ± .0.05 | 80.6 ± 0.24[a] |
| IPRO | 14 | 66.0 ± 0.32[b] | 73.6 ± 0.81[b] | 3.4 ± 0.51[b] | 1.4 ± 0.07[b] | 75.8 ± 0.86[d] |
| | 28 | 67.0 ± 0.71[b] | 74.4 ± 0.51[b] | 2.8 ± 0.37[b] | 1.32 ± 0.06 | 79.0 ± 0.71[d] |
| | 42 | 65.8 ± 0.58[a] | 68.8 ± 0.86[a] | 2.4 ± 0.24[b] | 1.28 ± 0.04[c] | 73.2 ± 1.02[d] |

Means (± S.E) with different superscript (a,b,c,d) within the same column are significantly different at $p<0.05$.

Also, significant increase in serum total protein levels was observed in IPRE group when compared to INT group.

*Serum AST, ALT, uric acid, Creatinine and glucose*:
The obtained data (table 3) showed that there was significant increase in serum AST, ALT activities, serum uric acid and Creatinine concentration in INT and IPRE groups compared to the control group. Meanwhile at the end of experiment, there was significant decrease in serum AST and ALT activities in IPRE group when compared to INT group. There was significant decrease in serum glucose concentration in NPRE and IPRO groups when compared to the control group and INT group respectively.

*Serum Lipogram*:
There was significant decrease in serum triacylglycerols, total cholesterol, low density lipoproteins cholesterol (LDL-c) and very Low density lipoproteins cholesterol (LDL-c), and significant increase in high density lipoprotein cholesterol (HDL) in NPRE group when compared to the control group. Also, a significant decrease in serum triacylglycerols, total cholesterol, low density lipoproteins cholesterol (LDL) and very Low density lipoproteins cholesterol (LDL) were observed in IPRE group in comparison with INT group. (Table 4)

Table 4 Lipogram in different groups:

| Group | Age | Triglycerides (mg/dl) | Cholesterol (mg/dl) | HDL (mg/dl) | LDL (mg/dl) | VLDL (mg/dl) |
|---|---|---|---|---|---|---|
| Control | 14 | 188.4 ± 1.69$^{a}$ | 214.6 ± 1.03$^{a}$ | 38.0 ± 0.45$^{a}$ | 138.92 ± 0.88$^{a}$ | 37.68 ± 0.34$^{a}$ |
| | 28 | 182.0 ± 0.71$^{a}$ | 208.8 ± 2.06$^{a}$ | 39.2 ± 0.58$^{a}$ | 135.2 ± 1.04$^{a}$ | 36.6 ± 0.14$^{a}$ |
| | 42 | 185.0 ± 0.32$^{a}$ | 208.0 ± 0.32$^{a}$ | 33.5 ± 0.79$^{a}$ | 137.5 ± 1.17$^{a}$ | 37.0 ± 0.06$^{a}$ |
| NPRO | 14 | 179.6 ± 0.51$^{b}$ | 205.8 ± 1.36$^{b}$ | 41.2 ± 0.37$^{b}$ | 128.68 ± 1.16$^{b}$ | 35.92 ± 0.1$^{b}$ |
| | 28 | 179.8 ± 0.86$^{b}$ | 201.4 ± 0.51$^{b}$ | 42.8 ± 0.37$^{b}$ | 128.2 ± 0.35$^{b}$ | 35.8 ± 0.06$^{b}$ |
| | 42 | 182.2 ± 0.73$^{b}$ | 204.6 ± 1.03$^{b}$ | 40.4 ± 0.87$^{b}$ | 130.16 ± 1.88$^{b}$ | 36.44 ± 0.15$^{b}$ |
| INT | 14 | 185.4 ± 0.81$^{c}$ | 208.0 ± 0.32$^{c}$ | 37.2 ± 0.58$^{a}$ | 133.7 ± 0.76$^{c}$ | 37.08 ± 0.16$^{c}$ |
| | 28 | 185.6 ± 0.51$^{c}$ | 202.8 ± 1.16$^{c}$ | 39.0 ± 0.32$^{a}$ | 127.8 ± 1.26$^{c}$ | 37.0 ± 0.14$^{c}$ |
| | 42 | 184.6 ± 0.13$^{a}$ | 211.0 ± 0.95$^{c}$ | 34.4 ± 1.03$^{a}$ | 139.02 ± 0.85$^{d}$ | 36.92 ± .21$^{a}$ |
| IPRO | 14 | 185.4 ± 1.63$^{c}$ | 206.0 ± 0.71$^{c}$ | 38.6 ± 0.51$^{c}$ | 130.2 ± 0.85$^{d}$ | 37.2 ± 0.17$^{c}$ |
| | 28 | 183.4 ± 0.45$^{d}$ | 202.6 ± 0.93$^{c}$ | 44.0 ± 0.71$^{d}$ | 114.4 ± 0.55$^{d}$ | 36.6 ± .0.09$^{d}$ |
| | 42 | 181.6 ± 1.44$^{d}$ | 204.0 ± 0.71$^{c}$ | 35.8 ± 0.37$^{c}$ | 131.88 ± 0.37$^{d}$ | 36.32 ± 0.29$^{d}$ |

Means (± S.E) with different superscript (a,b,c,d) within the same column are significantly different at $p<0.05$.

*Protein electrophoresis*:
There was significant increase in serum alpha, beta and gamma globulins of NPRO group compared to the control group. While there was significant increase in serum alpha and beta globulins of INT and IPRO groups compared to control group (Table 5).

Table 5 Electrophoretic pattern in treated groups

| Group | Alpha (g/dl) | Beta (g/dl) | Gamma (g/dl) |
|---|---|---|---|
| Control | 0.39 ± 0.01$^{a}$ | 0.65 ± 0.03$^{a}$ | 1.57 ± 0.07a |
| NPRO | 0.45 ± 0.003$^{b}$ | 0.75 ± 0.01$^{b}$ | 1.81 ± 0.01$^{b}$ |
| INT | 0.53 ± 0.01$^{c}$ | 0.82 ± 0.02$^{c}$ | 1.52 ± 0.5$^{a}$ |
| IPRO | 0.54 ± 0.02$^{c}$ | 0.73 ± 0.03$^{c}$ | 1.66 ± 0.08$^{a}$ |

Means (± S.E) with different superscript (a,b,c,d) within the same column are significantly different at $p<0.05$.

*Haemagglutination inhibition (HI) test*:
There was significant increase in antibody titer in NPRE group compared to the control group. Also, there was significant increase in antibody titer in IPRE group when compared to INT group (Table 6).

*Phagocytic activity and Phagocytic index*:
There was significant increase in Phagocytic activity and Phagocytic index of NPRE compared to the control group. However, there was significant decrease in

Phagocytic activity and Phagocytic index of INT compared to the control group. A significant increase in phagocytic activity and phagocytic index were observed in IPRE when compared to INT group (Table 7).

Table 6 Haemagglutination inhibition test in different groups

| Group | 2 weeks | 4 weeks | 6 weeks |
|---|---|---|---|
| Control | $3.2 \pm 0.12^{a}$ | $3.4 \pm 0.19^{a}$ | $3.5 \pm 0.22^{a}$ |
| NPRO | $4.2 \pm 0.12^{b}$ | $4.5 \pm 0.22^{b}$ | $4.5 \pm 0.22^{b}$ |
| INT | $3.3 \pm 0.24^{a}$ | $3.5 \pm 0.22^{a}$ | $3.4 \pm 0.2^{a}$ |
| IPRO | $3.9 \pm 0.37^{c}$ | $4.3 \pm 0.02^{c}$ | $3.9 \pm 0.24^{c}$ |

Means (± S.E) with different superscript (a,b,c,d) within the same column are significantly different at $p<0.05$.

Table 7 Phagocytic activity and phagocytic index in different groups

| Group | PA | PI |
|---|---|---|
| Control | $17.0 \pm 0.32^{a}$ | $1.52 \pm 0.04^{a}$ |
| NPRO | $20.2 \pm 0.37^{b}$ | $1.9 \pm 0.05^{b}$ |
| INT | $15.4 \pm 0.51^{c}$ | $1.38 \pm 0.07^{c}$ |
| IPRO | $18.4 \pm 0.68^{d}$ | $1.58 \pm 0.04^{d}$ |

Means (± S.E) with different superscript (a,b,c,d) within the same column are significantly different at $p<0.05$.

## 4. DISCUSSION

Concerning to leukogram, there was significant increase in total leukocyte count (leukocytosis and lymphocytosis) when prebiotic was used, this may be attributed to immunostimulatory and immunomodulatory effect of prebiotic. The obtained results in agreement with EL-Boshy et al. [10] who reported that, the absolute lymphocyte count (ALC) values on both day 21 and 42 were significantly increased in supplemented group with prebiotic indicating better immune response that could be attributed to immunostimulatory effect of r prebiotics. Meanwhile after Salmonella challenge there was a significant increase in total leukocyte count and heterophils count compared to control group. The obtained results are similar to those reported by Mensink [22] who observed that, there was a significant increase in WBCs and differential leukocytic count in *Oreochromis niloticus* treated with *Saccharomyces cerevisiae* (rich in beta-glucan). In contrary King and Seal [18] showed that, no significant change in total leukocyte count and differential leukocyte count observed in broiler treated with either protexin or propionic acid. Concerning serum proteins, there was significant increase in serum total protein and globulins and significant decrease in A/G ratio without change in albumin in NPRE group compared to control group, which may be due hyperglobinemia. There was significant decrease in serum total protein, albumin and A/G ratio and significant increase in globulins of INT group compared to control group, There was significant increase in Serum total protein and albumin of IPRE group compared to INT group. These results agree with reports by FAO [11) stated that, hyperprotinemia and hyperglobinemia were observed as beta-glucan administration. These results disagree with Al-Kassie et al. [1] who showed no significant differences in total protein, albumin and globulin between treatments with prebiotics. Gel electrophoresis showed that control and NPRE group characterized by high immunity through increasing gamma globulins due to effect of beta-glucan on immunity. Increase in alpha globulins in INT and IPRE may be due to infection with Salmonella. These results agree with Yun et al. [31] who found that beta-glucans of oats sources increase the concentration of serum immunoglobulins. The obtained results revealed that, there was no change in the AST and ALT activities in group received beta-glucan. The obtained results in agreement with Bernard et al. [2] who reported that, the dietary treatments with yeast derived beta-glucan and single-strain probiotics did not have significant effects on the activities of AST and ALT In broiler chicks. Also, agree with Al-Kassie et al. [1] who reported that no effect on serum ALT and AST activities were

observed by the addition of probiotic (*Saccharomyces cerevisiae*) rich in beta-glucan compared with control treatment. The obtained results revealed a significant increase in AST and ALT enzymes as a result of challenge with *Salmonella typhimurium* which cause hepatocellular damage [15]. Significant reduction was observed in glucose level in beta-glucan group compared with control group, these result agree with Al-Kassie et al. [1] who explain the reduction of glucose in groups receiving prebiotics compared with the control could be due to the positive effect of prebiotic on birds through decreasing stress factor on birds. Also, Braaten et al. [4] and Chauhan R.S. and Chandra [5] mentioned that, like other sources of soluble fiber, beta-glucan is helpful in reducing the elevation in blood sugar levels that typically follow a meal. On the other hand EL-Boshy et al. [10] found that β-1.3glucan has no significant effect on glucose level in Nile tilapia (*Oreochromis niloticus*). Concerning serum lipids, there was a significant decrease in concentration of serum triglycerides, total cholesterol, and low density lipoproteins cholesterol (LDL). On the other hand, there significant increase in high density lipoprotein cholesterol (HDL) in beta-glucan group was observed. Results similarly Mensink [22] found that, broiler which gave juice that contained ß-glucan for 5 weeks caused a reduction of 5% in cholesterol level. Yun et al. [31] explains that, the binding of cholesterol by beta-glucan and the resulting elimination of these molecules in the feces is helps reduce blood cholesterol. Concerning to kidney function, results revealed that there was no significant change in uric acid and creatinine. These result agree with EL-Boshy et al. [10] who found that β-1.3glucan has no significant effect on uric acid and creatinine level in Nile tilapia (*Oreochromis niloticus*). On the other hand there was a significant increase of uric acid and creatinine after challenge with *Salmonella typhimurium* as a result of renal damage. . Similar results recorded by Guo et al. [13] significant increase in serum uric acid and creatinine during the experimental period in Salmonella infected group. Regarding to antibody titer against Newcastle ND, there was a significant increase in antibody titer against ND as a result of administration of beta-glucan. Beta-glucan cause significant increase in phagocytic activity and phagocytic index in NPRE group. These results agree with Huff et al. [15] who found that, β-glucan of *Saccharomyces cerevisiae* elevates phagocytic activity and lymphocyte proliferation. On the other hand, there was a significant decrease in phagocytic activity and phagocytic index in infected non-treated group. This result was improved by using prebiotic.

## 5. DISCUSSION

From the obtained results concluded that, prebiotic did not induce any harmful effect on liver or kidney and it decrease serum lipid. Prebiotic can be considered as an immunopotentiators due to stimulation of immune system and it has the ability to reduce the adverse effect of *Salmonella typhimurium* infection in broiler chicks.

## 6. REFERENCE

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مجلة بنها للعلوم الطبية البيطرية
BENHA UNIVERSITY
FACULTY OF VETERINARY MEDICINE

# دراسة باثولوجية إكلينيكية لتأثير البيتا-جلوكان علي القيم الدموية، المناعية، والكيميائية الحيوية في بداري التسمين

**هادية أحمد سالم[1]، أسامة علي محمد عبد الله[2]، خالد محمد مصطفي فراره[1]**

[1] قسم الباثولوجيا الاكلينيكية -كلية الطب البيطري-جامعة بنها، [2] قسم الباثولوجيا الاكلينيكية – كلية الطب البيطري -جامعة قناة السويس

## الملخص العربى

أجريت الدراسة على بداري التسمين "سلالة هوبارد" لدراسة تأثير البيتا-جلوكان على كريات الدم البيضاء، وبعض العوامل الكيميائية الحيوية والاستجابة المناعية خلال 42 يوم. تم تقسيم ال 80 طائر تسمين إلى أربع مجموعات متساوية احتوت كل مجموعة علي 20 طائرعلى النحو الأتي: المجموعة الضابطة ، مجموعة البريبيوتيك (NPRE) ، المجموعة المصابة بالسالمونيلا التيفيميوريم والغيرمعالجة (INT) و المجموعة المصابة بالسالمونيلا التيفيميوريم والمعالجة بالبريبيوتك(IPRE). وقد استخدم بريبيوتيك بيتا جلوكان واخذت العينات عند اليوم 14, 28, 42 من العمر . وأسفرت النتائج عن وجود زيادة في كريات الدم البيضاء . كما أظهرت التحاليل الكيميائية الحيوية عن وجود زيادة معنوية في مستوي كلا من البروتين الكلي والجلوبيولن. ، وانخفاض كبير في الدهون الثلاثية والكولسترول الكلي والجلوكوز. لم يوجد تغيير معنوي في انزيمات الكبد و حمض البوليك والكرياتينين. اظهرت اختبارات المناعه زيادة في عدد الاجسام المضاده للفيروس المسبب لمرض النيوكاسل مع وجود زياده معنويه في قدره الخلايا الاكوله (مونوسيت) علي الابتلاع. وخلصت النتائج إلى أن هناك آثار مفيدة لمكمل الغذاء البريبيوتيك على الوضع الصحي لبداري التسمين.

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