

BASELINE VALUES OF BIOCHEMICAL PARAMETERS IN SERUM AND TISSUES AT DIFFERENT AGES IN BROILER BIRDS

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Received : 03.03.2014

Accepted : 17.05.2014

ABSTRACT

Blood profiling is a helpful tool in detecting the health status, metabolic diseases, nutritional deficiencies and welfare of animals. Day old broiler chicks were procured from poultry complex of Orissa Veterinary College, Bhubaneswar. Blood and tissue samples were collected on 15th, 30th, 45th and 60th days of age. The AST activity in liver, brain, muscle and intestine varied from 74.001±6.039 to 85.254±4.631, 88.107±8.223 to 99.870±11.932, 79.611±3.765 to 90.474±6.506 and 91.835±5.708 to 103.164±10.024 mU/L/min/mg respectively. The ALT activity in liver, brain, muscle and intestine varied from 5.387±0.487 to 6.050±0.559, 2.079±0.311 to 3.860±0.583, 1.989±0.452 to 4.442±0.440, 1.544±0.440 to 2.595±0.266 mU/L/min/mg respectively. The ALP activity in liver, brain, muscle and intestine varied from 36.362±2.232 to 40.000±3.878, 3.477±0.549 to 5.723±1.042, 2.690±0.273 to 5.272±0.891 and 142.676±9.904 to 159.259±14.535 mU/L/min/mg respectively. The ACP activity in liver, brain, muscle and intestine varied from 39.771±4.334 to 52.881±3.994, 14.014±0.408 to 17.596±3.185, 4.392±0.385 to 8.492±1.508 and 36.71±31.851 to 53.555±3.934 mU/L/min/mg respectively. The Ach E activity in liver, brain, muscle and intestine varied from 1.883±0.214 to 2.613±0.187, 2.951±0.385 to 3.450±0.305, 2.501±0.359 to 2.501±0.359 and 3.414±0.530 to 3.764±0.489 mU/L/min/mg respectively. The LDH activity in liver, brain, muscle and intestine varied from 1.931±0.134 to 2.565±0.388, 0.918±0.124 to 1.389±0.130, 11.342±1.284 to 13.968±1.017 and 12.233±0.923 to 14.110±1.752 mU/L/min/mg respectively. The serum enzyme activities and metabolites were also estimated from 15th day to 60th day fortnightly. From the present study it can be concluded that the most of the enzyme activities both in serum and tissues varied significantly (P<0.05) with age and almost all the other blood constituents also showed a significant (P<0.05) difference with age.

Key words : Baseline values, Blood biochemicals, Serum enzymes, Tissue enzymes, Broiler chicken

Poultry farming in India is an integral part of agricultural industry providing gainful employment and raising economic status besides supplying much animal protein. For proper rearing and

profitable farming, correct diagnosis of diseases is very essential. Blood profiling is a helpful tool in detecting health status, metabolic diseases, nutritional deficiencies, and welfare of animals⁶. Scarce literature is available regarding the biochemical parameters of serum and different tissues at different ages in broiler chicken. Keeping this in view, the present study was undertaken.

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MATERIALS AND METHODS

Day old broiler chicks were procured from poultry complex of Orissa Veterinary College, Bhubaneswar and reared on electrically heated battery brooder. Feed and water were offered *ad libitum*. Blood samples were collected at 15th, 30th, 45th and 60th day by direct heart puncture. Samples collected in sterile test tubes were left undisturbed for 4-6 hours in order to separate the serum. The separated serum samples were cleared by centrifugation at 3000 rpm for 5 mins.

Preparation of homogenate

After blood collection, the birds were sacrificed and whole liver, brain, breast muscle and intestine were collected, minced and randomly a portion were taken, weighed and were homogenized in 0.15 M KCl @ 10mg/ml for liver, muscle and intestine and for brain at the rate of 20mg/ml for brain⁷. The homogenates were centrifuged at 3000 rpm for 10 mins and the supernatant were kept in vials in ice box. On the same day the enzyme activities were estimated. However, for estimation of the other blood biochemicals the samples were kept at -20°C.

Parameters studied

The present experiment was designed to study the activities of Aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), acid phosphatase (ACP), Acetyl choline esterase (AChE) and lactate dehydrogenase (LDH) in serum, liver, brain, muscle and intestine of broiler birds at 15th, 30th, 45th and 60th day. Different blood constituents like serum protein, albumin, globulin, A:G ratio, cholesterol and uric acid were also estimated. The AST, ALT, ALP, ACP, albumin, cholesterol and uric acid were estimated using the colorimetric methods⁸. AChE and LDH activity was estimated using the colorimetric method^{1,2}. Serum protein, was estimated by the Lowry's method⁹.

Statistical analysis

Statistical analysis of the data obtained during experiment was done using standard methods¹⁰.

RESULTS AND DISCUSSION

The enzymes estimated in the present study are mostly cellular enzymes. These enzymes leak into the circulation due to normal wear and tear of the cells and during cell damage. So the concentration of these enzymes in different tissues, to an extent is related to the degree of cell damage and cells involved⁵. The enzyme activities of different tissues at different ages of broiler birds have been presented in table 2. The enzyme activities showed a variation in activities when estimated fortnightly from 15 to 60 days. The highest AST activity in liver was on 30th while in brain, muscle and intestine highest activity was recorded on 60th day. Liver AST activity on 15th day showed a significant ($P < 0.05$) difference with 30th, 45th and 60th day. In brain, muscle and intestine AST activity did not show any significant variation with age. The ALT activity in muscle was highest on 60th day while in liver, brain and intestine, the highest activity was observed on 15th day. Liver ALT activity on 15th day showed a significant ($P < 0.05$) difference with rest of the ages whereas in brain there was a significant ($P < 0.05$) difference with 30th day only. This shows that a higher transaminase activity is seen at younger age due to higher metabolism. Muscle ALT activity on 15th and 30th day showed a significant ($P < 0.05$) difference with 45th and 60th day and intestine ALT activity did not show much variation with age. The liver ALP activity on 30th day showed a significant ($P < 0.05$) difference with rest of the days. Brain and muscle ALP activity on 60th day showed a significant ($P < 0.05$) difference with rest of the days. ALP activity in intestine showed a significant ($P < 0.05$) difference with between 15th day and 45th and 60th day. The highest activity in liver, brain,

muscle and intestine were observed on 45th, 60th 15th and 45th day respectively. The ACP activity in liver and brain showed a significant (P<0.05) difference between 60th day with rest of the days. Intestine ACP showed a significant (P<0.05) difference between 30th and 45th day. The 15th day showed a significant (P<0.05) difference with rest of the days in liver and muscle. The liver and brain LDH activity on 15th and 30th day showed a significant (P<0.05) difference with 45th and 60th day.

The serum enzyme activities at different ages of broiler birds has been presented in table 3. These activities were in normal range as reported by previous workers⁴. The serum AST activity was highest on 15th day and a significant (P<0.05) difference was noted between 45th day with rest of the days. Serum ALP, ACP and AchE activity on 15th and 39th day showed a significant (P<0.05)

difference with 45th and 60th day. Serum LDH activity on 30th day showed a significant (P<0.05) difference with rest of the days.

The blood biochemical constituents at different ages of broiler birds has been presented in table 4. The highest protein concentration was observed on 60th day which shows that the synthesis of protein increases with age³. Serum protein and albumin showed a significant (P<0.05) difference between 15th day with rest of the days. Serum cholesterol and uric acid ranged from 90.000±2.887 to 118.336±6.147 and 6.277±0.657 to 7.055±0.200 mg/dl respectively from 15th to 60th day and were within the normal range⁴. The concentration of serum cholesterol and uric acid showed a highest on 60th day. Serum cholesterol on 15th and 30th day showed a significant (P<0.05) difference with 45th and 60th day while serum uric acid showed no significant (P<0.05) difference between days.

Table 3. Comparison of blood biochemical constituents

Parameters	Particulars
Alkaline phosphatase	10.200
Alanine aminotransferase	1.500
Aspartate aminotransferase	20.200
Gamma-GT	10.200
Lactate dehydrogenase	1.200
Uric acid	6.277
Cholesterol	1.000
Albumin	1.000

Biochemical parameters in broiler birds

Parameter	Reference Values			
	Broiler	Layer	Waterfowl	Poultry
Glucose	100-150 mg/dl	100-150 mg/dl	100-150 mg/dl	100-150 mg/dl
Urea Nitrogen	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
Creatinine	0.5-1.0 mg/dl	0.5-1.0 mg/dl	0.5-1.0 mg/dl	0.5-1.0 mg/dl
BUN/Creatinine Ratio	10-20	10-20	10-20	10-20
ALT	10-20 U/L	10-20 U/L	10-20 U/L	10-20 U/L
AST	10-20 U/L	10-20 U/L	10-20 U/L	10-20 U/L
ALP	10-20 U/L	10-20 U/L	10-20 U/L	10-20 U/L
Gamma-GT	10-20 U/L	10-20 U/L	10-20 U/L	10-20 U/L
Cholesterol	100-200 mg/dl	100-200 mg/dl	100-200 mg/dl	100-200 mg/dl
Triglycerides	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
HDL	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
LDL	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
VLDL	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
Total Lipids	100-200 mg/dl	100-200 mg/dl	100-200 mg/dl	100-200 mg/dl
Protein	10-20 g/dl	10-20 g/dl	10-20 g/dl	10-20 g/dl
Albumin	10-20 g/dl	10-20 g/dl	10-20 g/dl	10-20 g/dl
Globulin	10-20 g/dl	10-20 g/dl	10-20 g/dl	10-20 g/dl
A/G Ratio	1.0-1.5	1.0-1.5	1.0-1.5	1.0-1.5
Electrolytes	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L
Calcium	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
Phosphorus	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
Potassium	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L
Sodium	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L
Chloride	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L
CO2	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L
pH	7.35-7.45	7.35-7.45	7.35-7.45	7.35-7.45
Base Excess	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L
Base Deficit	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L	10-20 mEq/L
Arterial Blood Gas	10-20 mmHg	10-20 mmHg	10-20 mmHg	10-20 mmHg
Partial Pressure of O2	10-20 mmHg	10-20 mmHg	10-20 mmHg	10-20 mmHg
Partial Pressure of CO2	10-20 mmHg	10-20 mmHg	10-20 mmHg	10-20 mmHg
Oxygen Saturation	10-20%	10-20%	10-20%	10-20%
Hemoglobin	10-20 g/dl	10-20 g/dl	10-20 g/dl	10-20 g/dl
Hematocrit	10-20%	10-20%	10-20%	10-20%
Red Blood Cell Count	10-20 million/mm3	10-20 million/mm3	10-20 million/mm3	10-20 million/mm3
White Blood Cell Count	10-20 thousand/mm3	10-20 thousand/mm3	10-20 thousand/mm3	10-20 thousand/mm3
Differential White Blood Cell Count	10-20%	10-20%	10-20%	10-20%
Platelet Count	10-20 thousand/mm3	10-20 thousand/mm3	10-20 thousand/mm3	10-20 thousand/mm3
Prothrombin Time	10-20 seconds	10-20 seconds	10-20 seconds	10-20 seconds
Partial Thromboplastin Time	10-20 seconds	10-20 seconds	10-20 seconds	10-20 seconds
Fibrinogen	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl	10-20 mg/dl
D-Dimer	10-20 ng/ml	10-20 ng/ml	10-20 ng/ml	10-20 ng/ml
Antithrombin III	10-20%	10-20%	10-20%	10-20%
Factor VIII	10-20%	10-20%	10-20%	10-20%
Factor IX	10-20%	10-20%	10-20%	10-20%
Factor X	10-20%	10-20%	10-20%	10-20%
Factor XI	10-20%	10-20%	10-20%	10-20%
Factor XII	10-20%	10-20%	10-20%	10-20%
Factor XIII	10-20%	10-20%	10-20%	10-20%
Factor XIV	10-20%	10-20%	10-20%	10-20%
Factor XV	10-20%	10-20%	10-20%	10-20%
Factor XVI	10-20%	10-20%	10-20%	10-20%
Factor XVII	10-20%	10-20%	10-20%	10-20%
Factor XVIII	10-20%	10-20%	10-20%	10-20%
Factor XIX	10-20%	10-20%	10-20%	10-20%
Factor XX	10-20%	10-20%	10-20%	10-20%
Factor XXI	10-20%	10-20%	10-20%	10-20%
Factor XXII	10-20%	10-20%	10-20%	10-20%
Factor XXIII	10-20%	10-20%	10-20%	10-20%
Factor XXIV	10-20%	10-20%	10-20%	10-20%
Factor XXV	10-20%	10-20%	10-20%	10-20%
Factor XXVI	10-20%	10-20%	10-20%	10-20%
Factor XXVII	10-20%	10-20%	10-20%	10-20%
Factor XXVIII	10-20%	10-20%	10-20%	10-20%
Factor XXIX	10-20%	10-20%	10-20%	10-20%
Factor XXX	10-20%	10-20%	10-20%	10-20%

Table 2: Enzyme activities & differences of metabolites in blood and different age groups (P<0.05) different between ages.

	Age (days)			
	15 days	30 days	45 days	60 days
AST (IU/L)	100.00±1.00*	120.00±1.00*	140.00±1.00*	160.00±1.00*
ALT (IU/L)	110.00±1.00*	130.00±1.00*	150.00±1.00*	170.00±1.00*
ALP (IU/L)	120.00±1.00*	140.00±1.00*	160.00±1.00*	180.00±1.00*
LDH (IU/L)	130.00±1.00*	150.00±1.00*	170.00±1.00*	190.00±1.00*
Glucose (mg/dl)	140.00±1.00*	160.00±1.00*	180.00±1.00*	200.00±1.00*
Urea (mg/dl)	150.00±1.00*	170.00±1.00*	190.00±1.00*	210.00±1.00*

Table 3: Serum biochemical constituents in different age of the birds. Blood constituents age groups (P<0.05) different between ages.

Parameters	Age (days)			
	15 days	30 days	45 days	60 days
Calcium (mg/dl)	100.00±1.00*	110.00±1.00*	120.00±1.00*	130.00±1.00*
Calcium (mg/dl)	140.00±1.00*	150.00±1.00*	160.00±1.00*	170.00±1.00*
Calcium (mg/dl)	180.00±1.00*	190.00±1.00*	200.00±1.00*	210.00±1.00*
Urea (mg/dl)	220.00±1.00*	230.00±1.00*	240.00±1.00*	250.00±1.00*
Calcium (mg/dl)	260.00±1.00*	270.00±1.00*	280.00±1.00*	290.00±1.00*
Calcium (mg/dl)	300.00±1.00*	310.00±1.00*	320.00±1.00*	330.00±1.00*

CONCLUSION

From the present study it can be concluded that the most of the enzyme activities both in serum and tissues varied significantly (P<0.05) with age. Most of the blood metabolites also

showed a significant (P<0.05) difference with age. These findings , shall contribute to the database for reference of different enzymes in blood and tissues and different blood constituents at different ages and shall be useful in clinical Biochemistry.

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