

ACTIVITY OF SELECTED BLOOD SERUM ENZYMES IN GROWING BROILER CHICKENS

Dominika Pietruszyńska, Roman Szymeczko, Adam Brudnicki

University of Technology and Life Sciences in Bydgoszcz
Department of Animal Physiology
Mazowiecka 28, 85-084 Bydgoszcz

The objective of this study was to determine the effect of age on the response of enzyme activities in blood serum of growing broiler chickens. The research was conducted on Ross 308 chickens. Blood serum samples were collected three times at 14, 21 and 42 days of age. Significant effects of age were found for both aspartate aminotransferase (AST) and lactate dehydrogenase (LDH). There were no statistically significant age-dependent differences among alanine aminotransferase (ALT) and creatine kinase (CK). The results proved the effects of biochemical metabolic processes, resulting from selection for intensive growth in meat type chickens.

Keywords: broiler chickens, age, serum enzymes

1. INTRODUCTION

Meat type chickens are characterized by a fast rate of growth and good use of feed. For the economic reasons, broilers should also seal high performance slaughtered carcass with low proportion of fat, high quality of meat and good health and resistance to diseases [4]. In farm conditions fast-growing broiler chickens have health problems, manifested by constitutional weakness [9]. Both in the state of health or disease, it is possible to define by a certain level of systemic enzymes in blood serum, dependent on some factors, such as: breed, age, sex, nutrition, physiological state and welfare of animals. Measuring the level of indicator enzymes in broiler chicken blood serum can also be very helpful in monitoring herd health and disease diagnostics. Observations of enzyme activity are not generally appropriate in terms of production because of the modest amount or lack of data on physiological standards of hematological factors dependent on named above genetic and environmental factors [7, 6].

The aim of this study was to estimate the level of some enzymes in the blood serum of broiler chickens.

2. MATERIAL AND METHODS

The present study was performed with 14, 21 and 42 day-old male commercial broilers Ross 308. Birds were kept in a traditional poultry-house with an automatically controlled system of maintaining constant environmental conditions (temperature, air renewal and humidity), consistent with the recommendations of the technology of rearing chickens Ross 308. In the growth and development period all chickens had unlimited access to water and they were also fed *ad libitum* with a standard feed mixture corn-wheat-soya broiler starter mash until 21 days, followed by a grower mash from 22 to 35 days and a finisher type mash from 36 to 42 day of bird's life.

In 14, 21, 42 days, ten chicks with a similar body weight were chosen to the hematological tests. The obtained blood serum activity of the following enzymes was determined by means of a photometer Epoll 20 and reagents of Alpha Diagnostic:

- 1) aspartate aminotransferase AST (EC 2.6.1.1) in IU/l
- 2) alanine aminotransferase ALT (EC 2.3.1.2) in IU/l
- 3) lactate dehydrogenase LDH (EC 1.1.1.27) in IU/l
- 4) creatine kinase CK (EC 2.7.3.2) in IU/l

All data in the study were analyzed statistically using the Statistica 8.0 (Statsoft, Inc. 2008). A significance level of 0.05 was used.

3. RESULTS AND DISCUSSION

The results of enzyme activity in broiler chickens blood serum measured in the study are presented in Table 1.

Table 1. Enzymatic activity in blood serum of growing broiler chickens

Tabela 1. Aktywność enzymów w surowicy krwi rosnących kurcząt brojlerów

Enzyme Enzym	Age (days) Wiek (dni)		
	14	21	42
AST, IU/l	228.6 ^{1a}	234.8 ^a	280.3 ^b
	20.1 ²	45.1	36.9
ALT, IU/l	8.1 ^a	10.6 ^b	6.6 ^a
	2.4	2.3	1.2
LDH, IU/l	3097 ^a	2546.6 ^{a,b}	3923 ^b
	478.5	415.9	972.2
CK, IU/l	5369.3	5619.4	6368.3
	1494.9	1080.5	1617.6

¹ Mean value – Wartość średnia

² Standard deviation – Odchylenie standardowe

^{a, b} Mean values in the same row not sharing a common superscript are significantly different ($P < 0.05$)
– Wartości średnie w tym samym rzędzie oznaczone różnymi literami różnią się istotnie ($P < 0.05$)

The highest activity of aspartate aminotransferase 280.30 IU/l was observed in the oldest group of 42 day-old broiler chickens and it was significantly higher ($P < 0.05$) than in the younger broiler chickens. A significant effect of age in AST level was observed by Vyboh et al. 2006. In the studies conducted by other authors, a significant effect of age of chickens on the enzymatic activity of AST was not confirmed [1, 7]. The results of AST activity levels in chickens of different ages obtained in our study were similar to data presented by other authors [7, 2, 5]. Definitely lower activity of ALT than AST in bird's blood serum with no pathological changes in growing turkey's liver [8] excludes inflammation of the organs.

In 14 day-old birds, the activity level of alanine aminotransferase ALT was 8.10 IU/l. A significant increase in ($P < 0.05$) the enzyme activity to 10.60 IU/l was observed in 3 week-old chickens. At 6 weeks of age, the lowest level of ALT, 6.56 IU/l, was observed. It was similar to Krasnodębska-Depta's & Koncicki's studies (2000), moreover no significant effect of age on enzyme activity in growing broiler chickens was found. ALT levels observed in this study are lower than in earlier observations [10, 2].

The lowest 2545.63 IU/l lactate dehydrogenase LDH activity was found in 21 day-old broilers. A significant increase in enzyme activity was observed in the oldest group of birds (Table 1). The results obtained in this study for LDH level in chickens of different ages are higher than data presented by other authors [1, 3, 7, 5].

In these studies, the lowest activity of creatine kinase, CK 5369.33 IU/l, was found in blood of the youngest 14 day-old chickens. The increase in CK activity was observed in blood serum in older broilers at the age of 21 and 42 days. The highest, 6368.33 IU/l, CK activity was observed in blood serum of the oldest 6 week-old chickens, although there was no statistically significant age-dependent difference among the activity of this enzyme. The studies conducted by other authors reported a statistically significant effect of age on the activity of CK [7, 10], although in this study higher values of the enzyme activity were obtained [3, 7, 5]. It should be noted that the increase in the level of CK activity is characteristic of fast growing broiler chickens [3, 9].

4. CONCLUSIONS

1. Significant effects of age in this study were found for both aspartate aminotransferase (AST) and lactate dehydrogenase (LDH).
2. There were no statistically significant age-dependent differences among alanine aminotransferase (ALT) and creatine kinase (CK).

REFERENCES

- [1] Bowes V.A., Julian R.J., Stirtzinger T., 1989. Comparison of Serum Biochemical Profiles of Male Broilers with Female Broilers and White Leghorn Chickens. *Can J. Res.* 53, 7–11.
- [2] Dmoch M., Polonis A., 2007. Wpływ biopleksu miedziowego na wybrane wskaźniki hematologiczne, biochemiczne i zawartość składników mineralnych w krwi kurcząt brojlerów. [Influence of biopleks- Cu on hematological and biochemical indices and content of mineral components in blood of chicken broilers] *Acta Sci. Pol., Zootechnica* 6(3), 11–18.

- [3] Itoh N., Moritsu Y., Taniyama H., Ichikawa S., 1997. Correlation between Hart Muscle Damage and High- Nutrient Feed in Broiler. J. Vet. Med. Sci. 59(3), 209–211.
- [4] Jamroz D., Potkański A., 2006. Żywnienie zwierząt i paszoznawstwo. T. II. PWN Warszawa.
- [5] Koncicki A., Bukowska A., Kaniowski R., Koncicka K., 2009. Wpływ Silivetu na zdrowotność kurcząt brojlerów i indyków. [Effect of Silivet on the health of chicken broiler and turkeys]. www. Biofaktor.pl
- [6] Koncicki A., Krasnodębska-Depta A., 2005. Możliwości wykorzystania wyników badań hematologicznych i biochemicznych w diagnostyce chorób drobiu. Mag. Wet. (supl.), 20–22.
- [7] Krasnodębska-Depta A., Koncicki A., 2000. Fizjologiczne wartości wybranych wskaźników biochemicznych w surowicy krwi kurcząt brojlerów. [Physiological values of selected serum biochemical indices in broiler chickens]. Med. Wet. 56(7), 456–460.
- [8] Makarski B., Zadura A., 2006. Wpływ chelatu miedzi z lizyną na poziom składników hematologicznych i biochemicznych krwi indyków. [Influence of copper and lysine chelate on hematological and biochemical component levels in turkey blood]. Ann. Univ. Mariae Curie-Skłodowska, Sectio EE, Zootechnika XXIV, 48.
- [9] Olkowski A.A., Nain S., Ling B., Alcorn J., Wojnarowicz C.M., Laarveld B., 2008. Biochemical factors limiting myocardial energy in a chicken genotype selected for rapid growth. Comparative Biochemistry and Physiology A 149, 36–43.
- [10] Vyboh P., Rajman M., Jurani M., Lamosova D., Macajova M., Sedlackova M., Kostal L., Jezova D., 2006. The effects of feed restriction on plasma biochemistry in growing meat type chickens (*Gallus gallus*). Comparative Biochemistry and Physiology A 145, 363–371.

AKTYWNOŚĆ WYBRANYCH ENZYMÓW W SUROWICY KRWI ROSNAJĄCYCH KURCZĄT BROJLERÓW

Streszczenie

Celem badań było określenie wpływu wieku na aktywność enzymów w surowicy krwi rosnących kurcząt brojlerów. Badanie przeprowadzono na kurczętach Ross 308. Pobrano próbki osocza krwi trzy razy: w 14., 21. i 42. dniu życia. Stwierdzono istotny wpływ wieku zarówno dla aminotransferazy asparaginianowej (AST), jak i dehydrogenazy mleczanowej (LDH). Nie odnotowano statystycznie istotnych różnic w zależności od wieku w przypadku aminotransferazy alaninowej (ALT) i kinazy kreatynowej (CK). Wyniki wykazały wpływ biochemicznych procesów metabolicznych, wynikających z selekcji, na intensywny wzrost kurcząt typu mięsnego.

Słowa kluczowe: kurczęta brojlery, wiek, enzymy surowicy