Հայաստանի Գիտությունների Ազգային Ակադեմիա
Национальная Академия Наук Армении
National Academy of Sciences of Armenia

Հայաստանի Կենսաբանական Հանդես
Биологический Журнал Армении
Biological Journal of Armenia

• Համառոտ հաղորդումներ • Краткие сообщения • Short communications •

Biolog. Journal of Armenia, 4 (64), 2012

EFFECT OF HIGH LEVELS OF ZINC ON ANTIBODY RESPONSE AND TOTAL WHITE BLOOD CELL IN BROILER CHICKS VACCINATED AGAINST COCCIDIOSIS

S.A. SAJADIFAR

Faculty of Veterinary Medicine and Zootechnics, Armenian State Agrarian University
sajadifar.sobhan@yahoo.com

In this study one-day-old broiler chicks were used with three dietary zinc (40, 120 and 200 mg/kg). At 2, 22, 32, 42 days of age, the blood serums were tested for antibody titer against Newcastle disease vaccination (NDV), using the standard Haemagglutination Inhibition (HI) test. On 42 d, total white blood cells (WBC) were counted using a hemocytometer. At 42 d, levels of 120 and 200 mg Zn kg -1 diet were similar and significantly increased the antibody titer against NDV. Also both these two levels had a significant effect on total WBC, and increased it in compare with control group ($P< 0.05$). It seems that the use of these levels in broilers' diet could be considered a natural promoter of immune system against diseases.

Antibody titer – broiler – performance – white blood cell – zinc

Ցինկի 120 և 200 մգ/կգ չափաբաշիններով բրոյլեր ճտերին կերակրման դեպքում 42-րդ օրը նկատվել է նյութասլյան հիվանդության նկատմամբ վակցինացիոն հակամարմինների տիտրի բարձրացում և արյան մեջ լեյկոցիտների ընդհանուր քանակության ավելացում: Ցինկի նշված չափաբաժիններով բրոյլերներին կերակրումը կարելի է համարել օրգանիզմի բնական իմու-նախթանիչ:

Հակամարմինների տիտր – բրոյլեր – աճ և զարգացում – լեյկոցիտ – ցինկ

Нашими исследованиями установлено, что скармливание цыплятам цинка в дозах 120 и 200 мг/кг приводит к значительному повышению титра вакцинационных антител против болезни Ньюкасла и общему количеству лейкоцитов в крови на 42-й день. Использование указанных доз цинка можно рассматривать как естественную иммуностимуляцию организма.

Титр антител – бройлер – рост и развитие – лейкоцит – цинк

Coccidiosis is recognized as the parasitic disease that has the greatest economic impact on poultry production. The intestinal parasitism is a major stress factor that can lead to malnutrition and lowered performance. Depending on the localization, disease in poultry has two forms: coccidiosis of the caecum that is caused by Eimeria tenella and intestinal coccidiosis that is caused by a number of parasites: *E. necatrix*, *E. acervulina*, *E. maxima*, *E. brunetti*, *E. mitis*, *E. mivati*, *E. praecox* and *E. hagani*. Immunity against coccidiosis is highly specific and cross protection has not been documented. That means that different species of the parasite can cause disease in susceptible birds (Hofstad, 1984).

Having a healthy immune system will lead to prevention of diseases and increase of poultry's resistance. Balance of the nutrients is directly involved in optimizing the production function and variation in their levels can have a substantial impact on immune systems (Van der Zijpp, 1983). The objective of this study was to evaluate of effect of high levels of zinc on antibody titer against Newcastle disease vaccination and total white blood cells count in broiler vaccinated against coccidiosis.

Materials and methods. *Birds and treatments*. One hundred and forty-four one-day-old Ross 308 broiler chicks were used according to a completely randomized design, with three dietary zinc (Zn-So4) levels and four replicates of 12 birds. Three zinc levels (40, 120 and 200 mg/kg) were added to the basal diet (tabl. 1) to establish the treatments. On day 7, all broilers were vaccinated against coccidiosis (Livacox Q®, Merial) via oral administration. Birds were kept in floor pens, and diets and fresh water were provided ad libitum from day one. The lighting program used was 24 hours of artificial light during the entire experimental period, which lasted 42 days.

Table 1. Ingredients and calculated composition of the starter and finisher diets

Ingredients	Starter, %	Finisher, %
Corn	53.55	59.57
Soybean meal 44%CP	38.93	33.34
Monodibasic Phosphate	1.43	1.21
Limestone	1.35	1.38
Vegetable oil	3.84	3.51
Salt	0.41	0.43
DL-methionine	0.207	0.214
L-Lysine HCl	0.129	0.197
Choline HCl 60%	0.06	0.05
Mineral-vitamin premix[1]	0.1	0.1
Total	100	100
Calculated Nutrients		
Crude protein %	22	20
ME, kcal/kg	3,050	3,100
Calcium, %	0.9	0.85
Available phosphorus, %	0.4	0.35
Sodium, %	0.2	0.21
Chloride, %	0.27	0.29
Digestible Lys, %	1.15	1.07
Digestible Met,, %	0.49	0.48
Digestible Met+Cys %	0.81	0.77
Digestible Thr, %	0.78	0.71
Choline, mg/kg	1,420	1,300

1 - Composition (per kg): manganese, 75,000 mg; iron, 50,000 mg; copper, 8,000 mg; iodine, 750 mg; vitamin A, 8,000 kIU; vitamin D3, 2,000 kIU; vitamin K3, 1,800 mg; vitamin B1; 1,800 mg; vitamin B2, 6,000 mg; vitamin B6, 2,800 mg; vitamin B12, 12,000 µg; pantothenic acid, 10,000 mg; niacin, 40,000 mg; folic acid, 1,000 mg; biotin. 60,000 µg; selenium, 0.3 mg/kg. Basal diets Zn measured by atomic absorption spectrometer and Zinc contents were 74 and 72 mg/kg in starting and finishing basal diets.

Antibody responses .Birds of all groups were intramuscularly injected with 0.1 ml of killed Newcastle disease vaccine (Cevac®Broiler NDK) at eight days of age. Two blood samples from each replicate were collected at 2, 22, 32, 42 days of age. All the blood samples obtained from wing vein and serums were separated by 3000 rpm centrifuging for 15 min. The serums were tested for antibody against NDV, using the standard Haemagglutination Inhibition (HI) test and the results were expressed as log 2.

Total white blood cells (WBC) count On 42d, blood samples were collected from wing vein using sterile lancet. Briefly, 490µ / of brilliant cresly blue dye was mixed with 10µ / whole blood sample and total leukocytes were counted using a hemocytometer.

Statistical Analysis. Experimental data normality was verified, and then data were submitted to analysis of variance, using SAS (1997) software package. Means were compared using Duncan multiple test.

Results and Discussion. *Antibody responses*. Fig. 1 shows the effects of graded levels of Zn on antibody titer against Newcastle disease vaccination (NDV). At 22 and 32 d of age, broilers supplemented with 200 and 120 mg Zn showed a higher response respectively, whereas at 42 d, levels of 120 and 200 mg were similar and significantly increased the antibody titer against NDV ($p< 0.05$). Bartlett and Smith (2003) reported the broilers receiving 68 and 181 mg Zn had a higher response for total, IgM, and IgG antibodies.

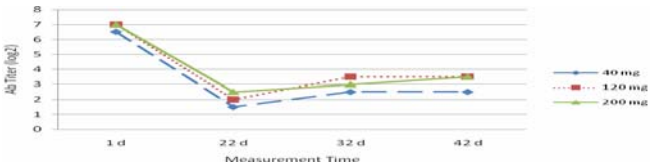

Fig.1. Antibody response of broilers fed different levels of zinc

Total white blood cells (WBC) count. Fig. 2 displays the effects of Zn supplementation on white blood cell count (WBC). Results shows that levels of 120 and 200 mg significantly increased WBC in compare with control. It can be due to effects of Zn on different parts of WBC including lymphocytes (Tanaka et al., 1990), monocytes (James et al., 1987) and neutrophils (Sunzel et al., 1995).

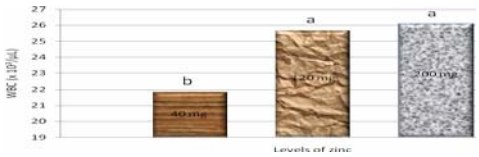

Fig.2. Effects of Zn supplementation on white blood cell count.
[a, b]Columns that do not share the same letters differ significantly ($p<0.05$)

The overall results of this study showed that both levels of 120 amd 200 mg Zn kg-1 diet seems to increase antibody titer against NDV and total WBC. The use of these levels in broilers' diet could be considered as a natural promoter of immune system against diseases.

REFERENCES

1. *Bartlett J.R. and M.O. Smith.* Effects of different levels of zinc on the performance and immunocompetence of broilers under heat stress. Poultry Science, *82*, 1580-1588, 2003.
2. *Hofstad, M.S.*. Diseases of poultry. Iowa State University Press. Ames. 1984.
3. *James S.J., M. Swendseid and T. Makinodan.* Macrophage-mediated depression of T-cell proliferation in zinc-deficient mice. J. Nutr. *117*, 1982-1988, 1987.
4. *SAS Institute:* SAS User's Guide. Statistics. SAS Institute, Inc., Cary, NC. Virden, W.S., Yeatman, J.B., Barber, S.J., Willeford, K.O., Ward, T.L., Fakler, *1997.*
5. *Sunzel B., S. Holm, C.O. Reuterving, T. Soderberg, G. Hallmans and L. Hanstrom.* The effect of zinc on bacterial phagocytosis, killing and cytoprotection in human polymorphonuclear leucocytes. APMIS, *103*, 635-644, 1995.
6. *Tanaka Y., S. Shiozawa, I. Morimoto and T. Fujita.* Role of zinc in interleukin 2 (IL 2) mediated T-cell activation. Scand. J. Immunol. *31, 547-552, 1990.*
7. *Van der Zijpp A.J.* The effect of genetic origin, source of antigen, and dose of antigen on the immune response of cockerels. Poult. Sci. *62*, 205–211, 1983.

Received 06.06.2012