

## The importance of calcium in the immunity of the body in chickens

Tahani S. S. Al-Azawi

Dept. of Physiology and Pharmacology  
College of Vet. Med. University of Baghdad

### Summary

Blood samples were obtained from clinically normal Fawbro chicks in order to study age – related blood changes in lymphocytes, globulin and calcium percentage. A total of 30 Fawbro chicks were kept from the first day of hatching till the fifty sixth day in one room and were fed on commercial starter and finisher rations. Two blood samples were taken from jugular or wing vein every week. One sample was used for total and differential leukocytic count, the other sample was used for serum isolation to estimate total protein, globulin and calcium amount, total plasma calcium estimation.

The results of this study provide an important reference and appear to be the first set of published data for the age – related blood values concerned with immunity in chickens. The important role of calcium in immunity is also reported and discussed here for the first time.

### أهمية الكالسيوم بالمناعة في الدجاج

د. تهاني سلمان شعوبي العزاوي

فرع الفسلجة و الأدوية / كلية الطب البيطري - جامعة بغداد

### الخلاصة

جمعت نماذج دم من أفراخ طبيعية نوع فاوبرو لدراسة التغيرات الحاصلة في نسبة الخلايا اللمفية و الكلوبولين و الكالسيوم مع تقدم العمر . تم استخدام 30 فروج لحم بعمر يوم واحد حيث ربيت في غرفة 4 X 3 م<sup>2</sup> و غذيت الأفراخ على عليقه أساسية بادئ ونامي و كان الماء و العلف يقدمان بصورة حرة طيلة فترة التجربة ثمانية أسابيع .

تم جمع نموذجين من الدم أسبوعياً من الأفراخ عن طريق الوريد الوداجي أو الجناحي حيث تم حساب العدد الكلي و التفريقي لكريات الدم البيض في أحد النموذجين . كما تم عزل مصل الدم من النموذج الثاني لحساب كمية البروتين الكلي و الكلوبولين وكذلك لحساب كمية الكالسيوم الكلي .

دلت نتائج هذه الدراسة على وجود علاقة طردية متزايدة مع تقدم العمر بين نسبة اللمفوسايت و الكلوبولين و الكالسيوم . وهذا بدوره يشكل مصدراً مهماً جداً لهذه الأقيام ذات العلاقة

بالمناعة و يشير و لأول مرة إلى دور الكالسيوم المناعية في الجسم بالإضافة إلى أهميته الفسلجية المعروفة .

### Introduction

Hematological analysis such as total white blood cell count and differential cell count provide information about the physiological and immunological status of an individual. Plasma or serum biochemical analysis provide information about internal organs, proteins and electrolytes. <sup>(1)</sup> Reported that melatonin hormone have an important role in immunity . Tryptophane which is the precursor for melatonin synthesis had been found to produce a significant increase in lymphocyte percentage, globulin and calcium amount in blood <sup>(2)</sup>. The elevation of serum total calcium level by tryptophane had been suggested to be due to its demand by the pineal gland for melatonin synthesis <sup>(3)</sup>. From the other hand, melatonin release produce a marked increase in calcium level by its stimulation to thyroid gland <sup>(4)</sup>. Thyroid hormones have been reported to elevate the plasma calcium level by increasing its intestinal absorption or bone resorption <sup>(5 and 6)</sup>.

Although, calcium serves a series of important functions beside its role in bone formation and mineralization, no clear evidence concerning its role in immunity. Thus, the aim of this study is to identify and explain the important role of calcium in immunity of the body.

### Materials and Methods

A total of 30 fawbro chicks were used in this study . They were kept from the first day till the end of the experiment (8 weeks) in a 3 X 4 m<sup>2</sup> room at the animal house of the College of Vet. Med. Baghdad. Feed and water was offered ad. libitum . They were fed on commercial normal starter and finisher rations. Blood samples were collected weekly from chickens for total and differential leukocytic count and for serum isolation. The percentage of lymphocytes were calculated from the differential leukocytic count according to <sup>(7)</sup>.

Globulin percentage was measured in serum from total protein – Albumin <sup>(8)</sup>. Serum total calcium level was measured as mentioned by <sup>(9)</sup>. All data were subjected to analysis of variance and LSD.

### Results

Figure 1 shows the total leukocytic count in chicks from one week till eight weeks. The number increases gradually with age. This increase is mainly due to the number of lymphocytes as shwon in Figure 2 which represents a gradual increase in lymphocyte percent from the first week of age till the

eighth week. The percentage increases from 51.8 in the first week to 65.2 in the fifth week to 70.3 in the eighth week.

Although, the amount of total serum protein was gradually decreased with age (fig.3), the percentage of globulin increases significantly ( $P < 0.01$ ) from 1.14 in the first week to 8.91 in the fifth week to 17.57 in the eighth week (fig.4).

The serum total calcium (mg /dl) shows a gradual linear elevation with age ( $P < 0.01$ ) follow that of lymphocyte and globulin amount (fig.5). In the first week Ca% was 6.1 then increases to 7.9 in the fifth week and 11.3 in the eighth week.

Figure 1: Total leukocytic count ( Xx 10<sup>3</sup> / L )

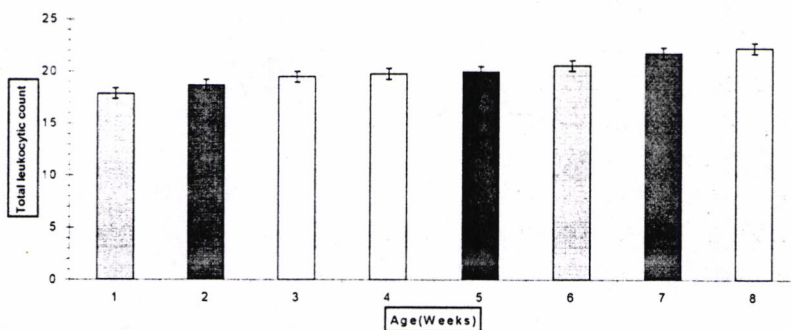


Figure 2 :Lymphocyte % in chicks from 1-8 weeks

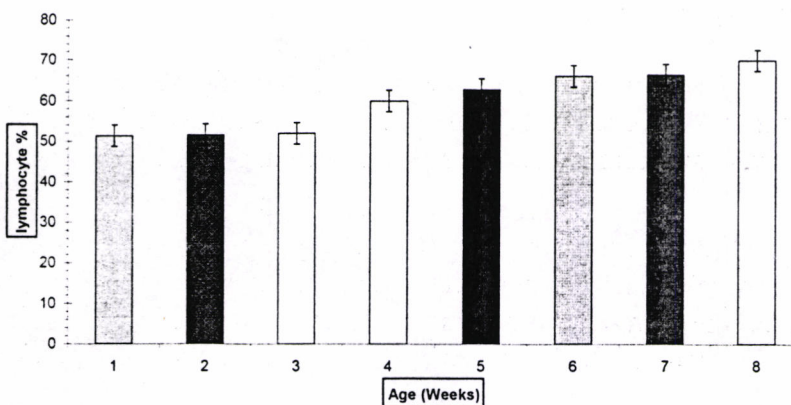


Figure 3: Total protein in serum of chicks from 1-8 weeks

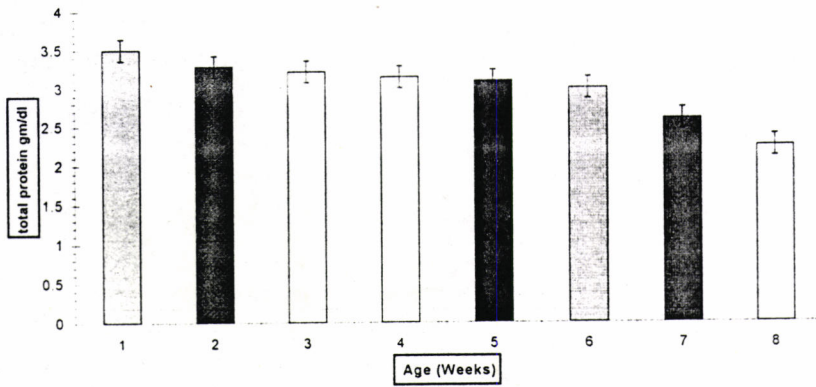


Figure 4 : Globuline % in chicks from 1-8 weeks

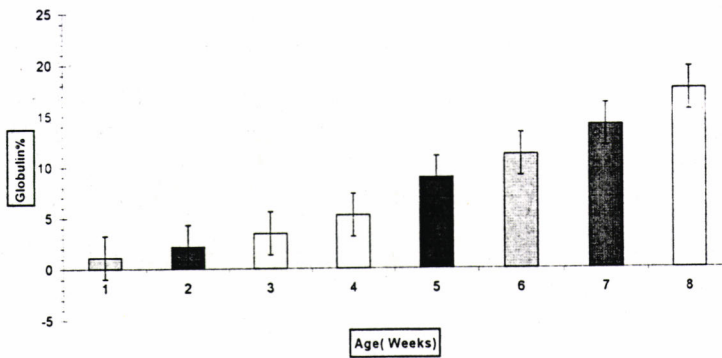
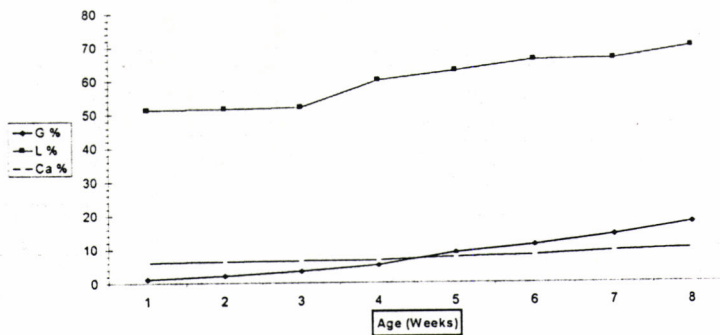


Figure 5: Lymphocyte , Globulin , Calcium in chicks from 1-8 weeks



### Discussion

The number of total leukocytes increased gradually from the first week till the eighth week. This increase has been related especially to the number of lymphocytes. The (Heterophil/Lymphocyt) ratio have been found to be stable after the second week of age<sup>(10)</sup>. This has been suggested to be due to the effect of corticosteroid hormones which found to kill lymphocytes during the first week of age through the activation of lysis gene. Isobe and Lillehoj<sup>(11)</sup> showed a marked elevation of corticosteroid hormones at the first week after hatching.

The increase in lymphocytes after the second week is mainly associated to its role in immunity. Lymphocytes play a great role in the cellular and humoral immunity of the body<sup>(12)</sup>. The elevation of globulin amount is coincides with the increase in lymphocytes number and could be explained simply by their role in immunity. It has been reported that the Bursa of fabricia of birds produces B-lymphocytes which carry immunoglobulin on their surfaces and responsible for humoral immunity<sup>(13)</sup>. It has been suggested that the increase in lymphocyte percentage after tryptophane is mainly due to the stimulation effect of interleukin 5(IL-5)<sup>(2)</sup>.

Whether, calcium is involved directly in immunity of the body or not, has not been investigated yet. This study appear to explain this role for the first time. Most of total calcium in blood is found in the plasma. In this study there is an increase in serum total calcium level with age parallel to that of lymphocytes and globulin. This suggest a direct role of calcium in immunity of birds either by increasing synthesis and releasing of some interleukines or immune factors involved in immunity of the body.

### References

1. Al-Azawi, T.S.S.; Rahdi, A.K.J. and Habib, A.A.W. (2002). Melatonin hormone importance in the body. *Iraqi. J. of Vet.Sci.* 15.(1): 42.
2. Jumah, S.H. and Al-Azawi, T.S.S. (2002). L – tryptophan importance in broilers 27th World Veterinary Congress Tunis, Tunisia. September 25 – 29
3. Pablos, M.I.; Agapito, M.T., Guteirrez, B.R.; Reiter, R.J; Recio, J. (1996). Effect of calcium on melatonin secretion in chick pineal gland, *Neuro.Sci.Lett.* 217 (2-3): 161 –164.
4. Kuhn, E.R.; Decuypere, E.; Coleu, L.M; and Michels, H. (1982). Post hatch growth and development of a circadian rhythm for thyroid hormone in chick incubated at different temperatures. *Poult.Sci.* 61: 540-549.

5. Cross, H. S.; Polzleitner, D., and Peterlike, M. (1986) Intestinal phosphate and calcium absorption. Joint regulation by thyroid hormones and 1,25 dihydroxy vitamine D3. *Acta.End*, 113:96-103.
6. Al-Azawi, T.S.S. (2000). The relation-ship between thyroxin and calcium metabolism in laying hens. *Iraqi.J.Agric*.5(6): 144-149.
7. Campble, T.W. (1988). *Avian haematology and Cytology*. First ed. Iowa state University Press/ AWES.
8. Wootton, I.D. (1964). *Micro –Analysis: Medical biochemistry – 4th ed.* J and A. Churchill, Ltd. London WI.
9. Gindler, F.M., and King, J.D. (1972). Rapid calorimetric determination of calcium in biologic fluids with methyl thymol blue. *Am.J. of Clinical Pathology* .58:376 –382.
10. Al-murrani, W.K.; Al-Azawi, T.S.S.; and Al-Mossawy, A.H. (2002). Hetrophil / Lymphocyte ratios during postnatal stages in chicken.1(12) .
11. Isobe, T. and Lillehoj, H.S (1992). Effects of corticosteroids on lymphocyte sub populations and lymphokine secretions in chickens. *Avian Dis*. 36:590-596.
12. Strurkie, P.D. (2000). *Avian Physiology*, 5th ed. Springer Verlag, NY.
13. Toivanen, A.; Nauk Karineu; Vainio, O. (1987). What is the function of Bursa of Fabricius? In: *Avian Immunology: Basis and practice* .CRC. Press.