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## A Deficiency in the Slow Moving Immunoglobulin in Awassi Sheep

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**Abstract:** A deficiency in the slow moving gamma globulin in an eight-month-old emaciated female Awassi sheep is described. Analysis of serum protein electrophoresis (SPE) on cellulose acetate of this sheep revealed the presence of three fractions only; albumin (alb),  $\alpha$  and  $\beta$  compared with that of the normal sheep which showed four fractions (alb,  $\alpha$  and  $\beta$  and  $\gamma$ ). This finding occurred in a ewe which belonged to a closed breeding system awassi flock. Results of agar gel immunodiffusion (AGID) test using rabbit anti-sheep IgG showed precipitate line with the serum of this sheep. Analysis of sera from her mother, the sister of the mother which is a twin of the mother, and from a six-month-old lamb of the latter, showed normal SPE profiles and were positive in AGID TEST. These results suggest that the ewe in this study was most likely deficient in the slow moving gamma globulin, perhaps IgG2, and this could not be due to a lack of colostral transfer from the dam because the ewe should have developed her own immunoglobulins by this age. It is possible that the animal suffered from abnormalities in plasma cell development, maturation and function.

**Key Words:** Sheep, immunoglobulin, deficiency, serum-protein-electrophoresis

### İvesi Koyunlarında Yavaş Hareket Eden İmmunglobulin Yetmezliği

**Özet :** Aşırı zayıflama bulunan sekiz aylık bir dişi İvesi koyununda saptanan, yavaş hareket eden gamma globulin yetmezliği bildirilmektedir. Sellüloz asetat üzerinde bu koyunun serum proteinlerinin elektroforez analizi sonuçları, normal koyunlarda görülen dört fraksiyonun (albumin, alfa-, beta ve gamma globulin) aksine, hayvanda sadece üç fraksiyonun: albumin, alfa ve beta globulin bulunduğunu ortaya koymuştur. Bu bulgular kapalı bir sistemde yetiştirilen ivesi sürüsünde bulunan bir dişi koyunda saptanmıştır. Bu koyunun kan serumu, tavşan anti-koyun IgG'si kullanılan agar jel immunodiffüzyon (AGID) testinde presipitat oluşturmuştur. Söz konusu olan koyunun annesinden, annesinin ikizi olan başka bir koyundan ve onun da altı aylık yavrusundan alınan kan serumlarının analizlerinde ise, normal serum protein elektroforez (SPE) profilleri göstredikleri-AGID testinde pozitif sonuç verdikleri ortaya konulmuştur. Bu bulgular, çalışmada incelenen koyunun yavaş hareket eden gamma globulinlerden, muhtemelen IgG2'den, yoksun olduğunu ve bu eksikliğin, bu yaştaki bir koyunun kendi immunglobulinlerini sentezleyebilmesi gerektiğinden dolayı, kolostral transfer noksanlığından kaynaklanmadığını göstermiştir. Hayvanda muhtemelen plazma hücrelerinin gelişiminde, olgunlaşmasında ve fonksiyonlarında bir anomali bulunduğu sonucuna varılmıştır.

**Anahtar Sözcükler:** Koyun, immunglobulin, yetmezlik, serum-protein-elektroforez

### Introduction

Gamma globulins deficiency is a very rare condition in animals with only a few cases described [1, 2, 3,]. Of these few, most were in horses [4, 5, 2, 6]. This disease has been observed in neonatal animals and have been associated with early deaths after birth [2, 7]. Selective deficiency in immunoglobulin classes and subclasses in Arabian horses, in red Danish milk breed and in large beagle breed has been also reported [8, 9, 10]. In adult sheep however, deficiency in immunoglobulin classes or subclasses has not been reported. Therefore, we present a case of eight-month-old-emaciated, eleven healthy sheep and three genetically related and three unrelated sheep to the sheep pre-

sented in this paper (serial # 4239) was also performed.

### Materials and Methods

#### Animals

Eleven sheep including the sheep (serial # 4239) were from the flock raised at the Agriculture Research Station at the university, they were separated for close supervision because they suffered from chronic emaciation. The animals were treated with tetracycline, antiparasitic medications and vitamins and minerals. In this flock a closed breeding system was implemented.

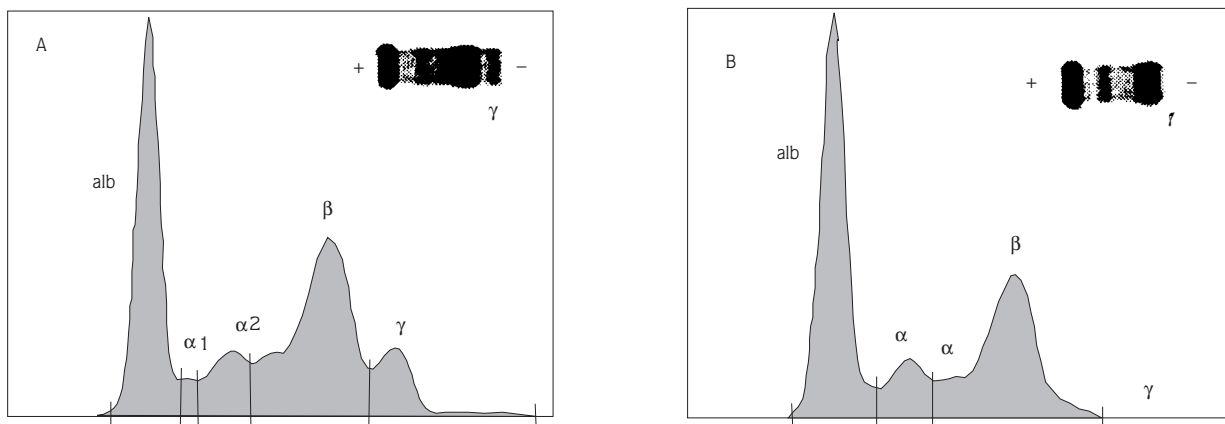


Figure 1. Serum protein pattern and the electrophoretogram obtained following separation on cellulose acetate for healthy sheep (A) and the diseased (4239) sheep (B). Barbitol buffer, pH 8.6 was used. The anode is on the left. The bands from the left to the right are alb,  $\alpha$ ,  $\beta$ , and  $\gamma$  globulins. The  $\gamma$  fraction was 0% and 11% in the diseased and health sheep respectively.

### Serum Protein Electrophoresis

Sera from the eleven emaciated sheep, three genetically related and three unrelated sheep to the sheep (serial # 4239) and from eleven apparently healthy sheep were separated on cellulose acetate (CA) in barbitol buffer, pH 8.6 as described previously [11]. Protein bands were visualized after staining and were counted by a recording and integrating densitometer (Beckman industries Unc. Fullerton, Calif).

### Results

Figure 1 shows SPE profile of the sheep (serial # 4239) and the healthy sheep. Only three fractions of the sheep serum proteins were observed: albumin (alb),  $\alpha$  and  $\beta$  fractions compared to serum from healthy sheep of the same age which showed four major fractions: alb,  $\alpha$ ,  $\beta$  and  $\gamma$  fractions. Figure 1 also shows the CA electrophoretogram of the # 4239 sheep and the healthy sheep. The percentage of serum proteins in the sheep was 51% for alb, 10 % for  $\alpha$  39 % for  $\beta$  and 11 % for  $\gamma$  globulin. For the healthy sheep, the values were 40 % for alb, 10 % for  $\alpha$  39 % for  $\beta$  and 11% for  $\gamma$  globulin.

To further investigate this case, agar gel immunodiffusion (AGID) test, using rabbit anti-sheep IgG, was done. The serum from the sheep showed precipitate line after 24 hours of incubation, but the line was slightly less in density than that of normal sheep which had normal SPE profiles (data not shown). This finding demonstrates that the sheep had IgG.

Because this sheep belonged to a closed breeding

flock, serum from the mother of the ewe which had the deficiency (serial # F669), the sister of the mother (serial # 670), which was a twin of the mother, and from a six-month-old lamb of the latter (serial # 4281), were collected and analyzed on CA and by AGID test. All these three animals, in addition to three unrelated sheep, showed normal SPE profiles and were positive with anti-sheep IgG in AGID test.

### Discussion

The fact that this sheep was deficient in  $\gamma$  fraction and positive for IgG in AGID test indicates that the sheep most likely was deficient in IgG2; it has been shown in ruminants that the slow moving gamma globulin on CA was IgG2 [12]. While IgG2 is found in gamma fraction, IgG1, IgM, and IgA are found in the  $\beta$  fraction [12].

IgG2 deficiency, which was transient in sheep has been reported in neonatal lambs and seemed to result from feeding of colostrum because the ewe should have developed her own IgG by this age. Loss or lack of activation of Bruton's tyrosine kinase (Btk) were reported to be crucial for lymphocytes development in human or for agammaglobulinemia in mice, respectively [14]. Additionally, a lethal immunodeficiency disease of arabian foals was reported to be due to a simple recessive, autosomal gene [15]. An autosomal recessive lethal trait in Black Pied Danish Cattle with primary immunodeficiency has also been reported [16]. It is possible that the ewe in our case suffered from abnormalities in plasma cell development, maturation, and function.

The animal was dead when this finding was observed and only very limited amount of serum from this sheep was available to do further study. Although the cause of death in this ewe has not been determined, it is possible that the ewe suffered from a disease which was associated with this deficiency,

The mechanism of this deficiency is not clear at this time. Examination of the whole flock by analyzing

the SPE profiles of individual sheep and by using antibodies against classes and subclasses of sheep immunoglobulin hopefully will give a clue to the incidence of the slow moving immunoglobulin deficiency (IgG2) and to the mechanism underlines the deficiency of IgG2 in this sheep.

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