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### **Concentration of progesterone in blood serum in hens of the Polbar breed depending on age**

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Poziom progesteronu w surowicy krwi kur rasy polbar w zależności od wieku

**Summary.** The purpose of this study is to determine the level of progesterone in chickens of the Polbar breed. The concentration is determined in blood serum collected from each of 50 hens at 8, 12, and 18 weeks of age. Determining the concentration of progesterone was made by the Enzy-mo-immunoassay method using the MEIA microparticle analyzer AxSYM™ Abbott. Hens subjected to the experiment did not yet reach puberty. Progesterone levels in chickens increased with the age of the birds. Variability occurring in chickens of the Polbar breed was influenced by the considerable range of concentrations tested through the hormone in blood serum. We find a variety of factors having great impact on the concentration of progesterone in blood plasma, including the same genes that affect the physiology of the body. Concentrations of progesterone in blood serum of hens bred genetically may serve as reference values for poultry.

**Key words:** hen, progesterone, Polbar

#### INTRODUCTION

Progesterone is the starting compound in the formation of other sex hormones, both male and female. This hormone is produced in the ovary by the corpus luteum, and in animals by attaching the placenta, where it is responsible for maintaining pregnancy. In birds, due to the different manner of bringing offspring into the world, the corpus luteum does not arise. Progesterone was isolated in birds to the left gonad [Sturkie 1970]. The right gonad disappears during the embryonic stage and in adult females, it only acts in the rudimentary form, which is visible only microscopically [Turner and Bagnara 1978].

Progesterone affects nerve centers via the hypothalamic area in the secretion of pituitary gonadotrophic hormones and the nervous systems condition. This relationship also exists between the male reproductive system and pituitary system. Evidence supporting this fact can be obtained by removing the pituitary gland which causes symptoms similar to those of castration, and those that occur after excision of the gonads. Progesterone moving via different neural mechanisms regulates the release of the hormone LH, and thus begins the process of ovulation, occurring a few minutes after the deposit of eggs [Sturkie 1970].

In the body of mammals, progesterone along with estrogen stimulates the glands and secretory cells lining the fallopian tubes and uterus, preparing for the latter implantation of the embryo. In birds while in the oviduct, progesterone induces the production of the protein avidin. Both estrogen and progesterone are necessary for normal reproductive cycle of birds [Turner and Bagnara 1978].

The aim of this study was to determine levels of progesterone in blood serum of hens in the Polbar breed at 8, 12 and 18 weeks of age.

#### MATERIALS AND METHODS

The research material was blood, which in each case was collected from the 50 hens of the Polbar breed in 8, 12, and 18 weeks of age. Polbars were kept in the Teaching and Research Station for Small Animals under the name of Laura Kaufman, belonging to the Department of Biological Basis and Animal Production at the University of Life Sciences in Lublin. Birds were kept on litter straw in standardized conditions. During the rearing period they were kept in a room with windows, and after puberty were transferred to windowless poultry house, which is programmed to 14 hours of day light and optimum temperatures ranging from 16 to 20°C. Polbars were fed ad libitum compound all-mash DKM - 1 and DKM - 2 during the rearing period, and after the reclassification of a mix DJ. Blood samples were taken in the morning, after 12 hours of starving leaf veins. Serum was obtained from blood collected into Venosafe™ tubes having a capacity of 4 ml, containing a clotting activator. Determinations on concentrations of progesterone were made using the enzyme-immunoassay method using the MEIA microparticle analyzer AxSYM™ Abbott.

The obtained data was statistically analyzed and the results are summarized in the table, showing the average, standard deviation and minimum and maximum values. Verification of the significance of differences was performed using a one-way analysis of variance.

#### RESULTS AND DISCUSSION

As indicated by the results obtained in Table 1, it increases with progesterone levels of hens between the ages 12 and 18 weeks. Particularly large increases in their concentrations were recorded at 18 weeks of age, which can be explained by the sexual maturation period in chickens. According Rzaşa *et al.* [2007] sexual maturity is reached at 20–22 weeks of age and during this time period the hen begins laying. The Polbar breed reaches sexual maturity relatively late, at about 23, 5 weeks of age [Calik *et al.* 2006].

Table 1. The level of progesterone in the blood serum in hen Polbar breed depending on age  
(n = 50,  $\bar{x} \pm sd$ )

Tabela 1. Poziom progesteronu w surowicy krwi kur rasy polbar w zależności od wieku  
(n = 50,  $\bar{x} \pm s$ )

Age (in weeks) Wiek (tydzień życia)	Progesterone, nmol/l Progesteron, nmol/L	SD	Range Zakres
8	0.34 <sup>b</sup>	±0.21	0.03–0.76
12	0.37 <sup>b</sup>	±0.17	0.04–0.87
18	0.95 <sup>a</sup>	±0.18	0.68–1.36
Average Średnia	0.57	±0.34	0.03–1.36

<sup>a, b, c</sup> the mean values marked with different letters in the columns significantly differed at  $P \leq 0.05$

<sup>a, b, c</sup> średnie oznaczone różnymi literami różnią się istotnie w obrębie płci przy  $P \leq 0,05$

According to Turner and Bagnara [1978] levels of steroid hormones in the blood depend on the amount of available precursors and the ability of cells to produce new hormones. So far there is little available literature dealing with the level of serum sex hormones in poultry. No breed particular Polbar data. The concentration of progesterone in blood plasma is influenced by a number of substances on the basis of feedback from the axis hypothalamus – pituitary – gonads. The release of these compounds depends on genetics, but also on environmental factors such as temperature, nutrition, or light. Photoperiod plays an important role. Total egg production is increased after short sessions of strong light, when the birds are still asleep. Not without significance is the type of utilities used, and thus [Turner and Bagnara 1978]. According Rozenboim *et al.* [2007] in response to heat stress, it lowers the concentration of plasma progesterone. This correlation with a reduction in the amount of eggs, ovarian weight and number of large bubbles. The impact that feeding can have on the concentration of progesterone in blood plasma is still very little understood. Yet we know that keeping a system in the administration of feed restriction leads to increased production of eggs. This may be a consequence of the high concentrations of progesterone in the blood [Liu *et al.* 2004]. Drops in progesterone levels in ovarian follicles and blood plasma came before the break was observed in laying hens [Proszkowiec and Rząsa 2001]. Pauses in producing eggs can be induced artificially, for example, depriving hens of a complete diet for a few days and access to water. Changes in progesterone concentrations in plasma are combined with the changes in the ovarian follicles. This fact is explained by the hierarchal setup among follicles [Proszkowiec and Rząsa 2001].

According Rząsa *et al.* [2007] between the length of the secretory activity and the pituitary there is a positive correlation. But with the start of laying, and thus the acquisition of reproductive maturity, these hormones are secreted cyclically [Wojcik 1994]. Both FSH and LH as a stimulating influence on the production of progesterone in ovulation vesicles. According Sechmana *et al.* [2000] concentration of progesterone in the blood plasma increases rapidly after the start of laying and is maintained at a relatively high level also during egg laying. Hens of the Polbar breed, in which progesterone levels were measured in blood serum are not yet at the laying period, which means it does not extend for them the process of ovulation. Hence, low values of this hormone in blood plasma were obtained in the study.

## CONCLUSIONS

Steroid hormones in Polbar chickens showed upward trends in the serum as the maturation of sexual organs responsible for the production of progesterone. Progesterone levels in chickens significantly increased only in the 18 week of age, being at the level of 0.95 nmol/l. In previous periods it has shown quite similar values: 0.34 nmol/l at week 8 and 0.37 nmol/l at 12 weeks of age. It should be noted that hens subjected to the experiment have not yet reached puberty.

As mentioned, large impact on the concentration of progesterone in blood plasma is caused by a variety of factors including the same genes that affect the physiology of the body. The fact that results obtained were in a large range of concentrations, which were taken from individuals maintained under the same conditions. Few publications or reports on sex hormone concentrations in serum makes it difficult to compare with the results obtained from the results of Polbar in other breeds and even species of domestic fowl. Therefore, concentrations of progesterone in the blood serum of hens bred in genetically consolidated areas may serve as reference values for poultry.

Progesterone levels in chickens grow between 12 and 18 weeks of age.

Interindividual variability occurs in chickens affected by the Polbar breeds significant range of concentrations of the hormone in blood serum.

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**Streszczenie.** Celem niniejszej pracy było określenie poziomu progesteronu u kur rasy polbar. Koncentrację oznaczono w surowicy krwi, którą każdorazowo pobrano od 50 kur będących w 8, 12, i 18 tygodniu życia. Określenia stężeń progesteronu wykonano metodą enzymo-immunochemiczną z użyciem mikrocząstek MEIA w analizatorze AxSYM<sup>TM</sup> firmy Abbott. Poziom progesteronu u kur wzrastał wraz z wiekiem ptaków w badanym okresie. Zmienność osobnicza wystę-

pująca u kur rasy polbar wpłynęła na znaczny zakres stężeń badanego hormonu w surowicy krwi. Wartości stężeń progesteronu w surowicy krwi skonsolidowanej genetycznie rasy kur posłużyć mogą jako wartości referencyjne dla drobiu.

**Słowa kluczowe:** kury, progesteron, polbar