

# Researches on the immunological reactivity of domestic birds during hydric deficiency

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The partial hydric deficiency status was realized by strictly individual administering of water in the amount of 30% from the initial intake. The infection of poultry was developed by the aid of a vaccinal strain, *Pasteurella*, an attenuated strain used against the avian cholera.

The partial hydric deficiency in hen has as a characteristic feature a leucopenia, which has the highest level in the 8-10 days after the partial hydric deficiency. The ascorbinemia in the experienced group does not present statistic significant variations. Piruvicaemia in the experienced group presents an increasing, the maximum values being recorded at 14 days after deficienced started. The noticed modifications are linked to significant variations of packed cell volume, in the increasing way of this, correlated with the hydric deficiency evolution.

Poultry under the partial hydric deficiency become more sensible beside the pathogen action of *Pasteurella*, the doses of 0.5 ml broth culture of 24 days vaccinal strain of avium *pasteurella* being well supported by control birds, while the hydric deficienced ones are dying, having characteristic lesions of cholera. The severe leucopenia, the decreasing of  $\gamma$ -globulins and the increasing of piruvicemia contribute to the increasing of partial hydric deficienced poultry sensivity beside the pasteurilic infection.

**Keywords:** hens; hydric deficiency; infection; hematological; biochemical

## Introduction

Water, a nutrient, is essential for life, and intake is subject to marked interaction effects with environment. Little is known about actual requirements for normal physiological function within the TNZ (thermo-neutral-zone) or at thermal extremes. The water needs of livestock are filed from three major sources: a. free drinking water; b. water contained in feed; and c. metabolic water produced by oxidation of organic nutrients. The catabolism of 1 kg of fat produces 1190 g of water; 1 kg of carbohydrate produces 560 g of water; 1 kg of protein produces 450 g of water. Metabolic water is important to all animals, particularly those residing in dry environments. The first two sources are of major concern in the management of livestock, although in periods of negative energy balance, when i.e deposit fat and tissue protein are being utilized, metabolic water would be important.

Water deprivation is a potent osmotic stress and has significant effects on the hypothalamic machinery regulating body homeostasis. In chickens, the plasma arginine vasotocin (AVT) level increases during water deprivation which provides a good correlation between plasma AVT and osmolality (Koike et al. 1977, 1979; Arad and Skadhauge 1984; Arad et al. 1985; Stallone and Braun 1986).

The extremely special role of the hydric metabolism in the animal organism economy and also the most serious consequences manifested on different plans provoked by the hydric insufficiency statuses suggested us the developing of some researches concerning the existed correlation between the hydric intake disorders and the immunologic reactivity in poultry.

There are few reports regarding the hydric deficiency influence on animal organism, the most authors in the special literature studying the weight modifications, the ones of feed intake and also some alterations of humor order. (Bierer et al. 1965 a, b, c; 1966; Varachiu et al. 1970, 1971, 1972).

## Materials and methods

The researchers were carried out on a 49 adult hens livestock of special breeds, 24 hens being used for developing the partial hydric deficiency and infection and the rest ones for two control groups. The first control group was partials deficienced and non-infected and the second one received water ad libitum and it was infected in the same period with the strain as in the experienced group. The partial hydric deficiency status was realized by strictly individual administering of water in the amount of 30% from the initial intake.

The infection of poultry was developed by the aid of a vaccinal strain, *Pasteurella multocida* var. avium, an attenuated strain used against the avian cholera.

Each bird was subcutaneous inoculated in the 12<sup>th</sup> day of the partial hydric deficiency with 0.5 ml or 1 ml of 24 hours broth culture.

Blood samples were collected: 0; 10; 14; 20 and 26 days, by cubital venipuncture, blood was collected in covered vacutainers from each hen.

During the experiences there were taken in vivo the leukocyte dynamics, differential blood count, serous protein fractions, packed cell volume, ascorbinnaemia and piruvicaemia.

## Results and discussion

The poultry under the partial hydric deficiency became more sensible, comparatively with the controlled ones, at the infection of the aviar *Pasteurella* strain. The doses of 0.5 and 1 ml of a 24 hours broth culture of this strain, inoculated in the 12<sup>th</sup> day of the experience are supported in good conditions by the control group birds, while the hydric deficienced ones are dying having characteristic lesions to pasteurellasis, the bacteriologic examinations showing the large number of bacteria in blood and organs. The birds in the control group (deficienced and non-infected) survived the whole observation period.

The increased sensibility of the partial hydric deficienced birds beside the above mentioned pasteurellic infections is produced on the base of some large modifications of the studies blood features.

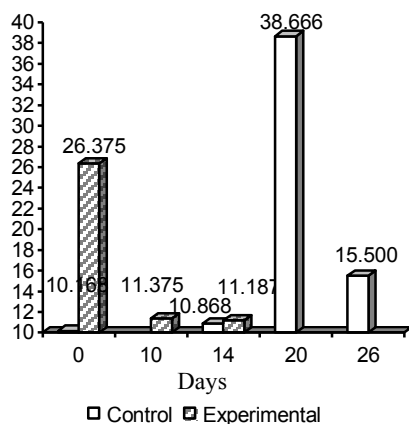
The partial hydric deficiency in hen has as a characteristic feature a leucopenia (Fig. 1), which has the highest level in the 8-10 days after the partial hydric deficiency, with a mean value of  $11375 \pm 87.7$  leukocytes/ $\mu$ l blood (43% of the initial wean value) beside  $26375 \pm 60.6$  leukocytes/ $\mu$ l blood initial mean fond. After infection, in the partial hydric deficienced group of hen, the number of white cells maintains within the same low limits ( $11187 \pm 63.7$  leukocytes/ $\mu$ l blood). At the ones which received water ad libitum and which were infected by the same bacterial strain, a leukocytosis could be notice ( $38666 \pm 378$  leukocytes/ $\mu$ l blood).

Within the differential blood count, we noticed the significant variations of eosinocytes which decreased from  $6.8\% \pm 2.56$ , the initial value, to  $0.4\% \pm 0.256$  at 48 hours after infection. At control ones it could not notice significant variations of eosinocytes.

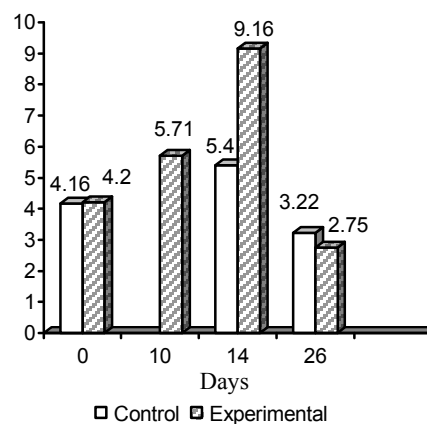
The significant modifications are presented into the ratio between the serous protein fractions. Thus, at the experienced group, after infection produces a significant decreasing of gamma and  $\beta$ -globulins, while albumines and  $\alpha$ -globulins have a significant increasing.

In the experienced group the ascorbinemia didn't present statistic significant variations (Fig. 2). In the control group of birds, which has water ad libitum, infected by the same strain of *Pasteurella* var. avium is recorded a significant decreasing of ascorbinemia after infection ( $3.22 \text{ mg}\% \pm 0.145$  initial mean fond), but the control group deficienced in water and non-infected it appeared an increasing of ascorbic acid concentration ( $9.16 \text{ mg}\% \pm 1.64$  beside  $4.20 \text{ mg}\% \pm 0.479$  the initial mean value).

In the experienced the piruvicaemia group presents an increase, the maximum values being recorded at 14 days after deficiencia started  $13.37 \text{ mg}\% \pm 0.784$  beside  $5.75 \text{ mg}\% \pm 0.02$  initial mean value (Fig. 3).

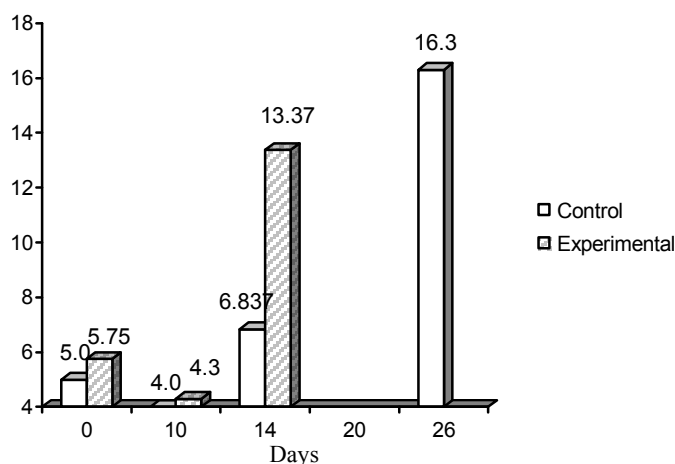


**Fig. 1 Dynamics of leukocytemia (10<sup>3</sup>/μl blood)**



**Fig. 2 Dynamics of ascorbinemia (mg/dl blood)**

The noticed modifications are linked to significant variations of packed cell volume, in the increasing way of this, correlated with the hydric deficiency evolution. Water loss from the body and parameters directly related to it, such as a decrease in body weight or an increase in plasma osmolality, depend to a large extent on the surface of the individual.



**Fig. 3 Dynamics of piruvicaemia (mg/dl blood)**

To some extent, water conservation is also related to the tolerance of animals to dehydration. Dehydration is a potent osmotic stress capable of producing both extracellular hyperosmolality and hypovolemia (Chaturvedi et al 2000, Seth and Chaturvedi 2004).

The data show that females were more adversely affected by osmotic stress as they registered significant losses in body weight ( $P < 0.05$ ) compared to their age-matched male counterparts.

Young birds also responded to osmotic challenge by showing increased plasma osmolarity and decreased body weight; however differences between the sexes were not statistically significant. These results suggest a possible role of sex steroids in the regulation of homeostasis (Koike et al. 1983, Xin and Lee 1997, Bell 1976).

## Conclusions

1. Poultry under the partial hydric deficiency become more sensible beside the pathogen action of *Pasteurella multocida* var. *avium*, the doses of 0.5 ml broth culture of 24 days vaccinal strain of *avium* *pasteurella* being well supported by control birds, while the hydric deficienced ones are dying, having characteristic lesions of cholera.

2. The severe leucopenia, the decreasing of  $\gamma$ -globulins and the increasing of piruvicemia contribute to the increasing of partial hydric deficienced poultry sensivity beside the pasteurellic infection.

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