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The Effect of Confinement on Differential Leukocyte Count of Laying Pullets

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INTRODUCTION

Animals may be subjected to stress in many forms. Overcrowding, disease, poor nutrition are a few of the stressful conditions frequently found in animal production. Some of these conditions, such as overcrowding may be intentionally imposed for the purpose of maximizing profit. For example, it has been the trend in poultry production to reduce the space allowed per bird in order to increase the overall capacity of a poultry house. This intentional crowding generally reduces the performance of individual birds as the result of increased social stress. However, some stress such as diseases occur inadvertently and can not always be avoided. Stresses individually and collectively can reduce animal efficiency.

It is important to be able to assess the effects of stress on animals. Various techniques have been employed as indicators of stress. One of these is based on the relationship between the number of certain blood cell types and the secretion of adrenal hormones. It has been shown that in certain species stress influences differential leukocyte counts. Thus, the changes in cell count is a measure of the response of the animal's body stress.

Pennebaker and Downs (4) reported changes in differential Leukocyte count when dwarf and normal cattle and mice were subjected to insulin stress. The normal animals exhibited eosinopenia, whereas dwarfs showed many immature granulocytes following insulin injection. Waltman *et al.* (6) discovered that isolated female mice showed a significant decrease in total leukocyte and eosinophil count as compared to the controls. Newcomer (3) and Glick (2) found that the total numbers and ratios of the various white blood cell types of the chick are influenced directly by adrenal steroids and indirectly by ACTH.

The aim of the present preliminary study was to investigate the effect of confinement on the differential leukocyte count of laying pullets.

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MATERIALS AND METHODS

A total of forty-eight Single Comb White Leghorn pullets, 20 weeks of age, were divided equally into four groups, 12 birds each, and were housed in laying cages and in a floor pen. The floor areas of the laying cages were 6×8 (15.2×20.3 cm) and 10×16 inches (25.4×40.6 cm). The pullets were housed one per cage in the smaller size and one to two per cage in the larger size. The cages were 18 inches (45.92 cm) high with slanting wire floors. The floor pen and the laying cages were located in an 8×10 ft (3×2.5 m) ventilated room with 14 hours of artificial light per day. The pullets in the floor pen were allowed 3 sq. ft (0.3 sq. m) floor space each.

Experimental groups were fed a standard laying diet containing 17.2% crude protein, 3% calcium and 0.6% phosphorus. Feed and water were available to the pullets *ad libitum*.

At 22 weeks of age and at each two weeks thereafter, blood samples from the wing vein were collected. Five to eight blood smears from each bird were prepared and stained with Wright's stain for differential leukocyte counts. The experimental period was 16 weeks.

RESULTS AND DISCUSSION

The effects of the four housing conditions on differential Leukocyte counts at the end of 16 weeks of lay are shown in Table 1. There were no significant differences in heterophils, eosinophils, basophils, lymphocytes and monocytes attributable to housing conditions. There was a trend for those pullets kept in 6×8 inch cages and those with two birds for each 10×16 inch cage to show a higher percent of heterophils than those housed one bird per 10×16 inch cage or on the floor. These data indicate an increase in heterophils as the space per bird is decreased. Lymphocytes tended to decrease as housing space decreased.

In birds, as in mammals, the influence of stress of confinement probably functions along the hypothalmic-hypophyseal-adrenocortical axis. Under the stress of confine-

Table 1 The effect of housing conditions on differential leukocyte count[1,2]

Housing Conditions	Heterophils	Eosinophils	Basophils	Lymphocytes[3]	Monocytes
	Percentage of total count				
Small cages 6″ × 8″	28	2	4	57	9
Large cages 10″ × 16″ one bird per cage	24	2	3	58	13
Large cages 10″ × 16″ two birds per cage	28	2	2	57	12
Floor	23	2	4	62	8

[1] Means in each column did not differ significantly ($P < 0.05$) when tested by analysis of variance, and student's "T" test.
[2] At 16 weeks into the laying period.
[3] Small and large lymphocytes combined.

ment, the neural stimuli reach the hypothalamus and are converted to neuro-humoral factor(s) which then stimulate the anterior pituitary to release ACTH. This in turn reaches the adrenals via the general circulation and causes an increase in the secretion of hormones. These hormones then influence the production of certain types of leukocytes (1, 5).

The results of this study provide inconclusive evidence that leukocytes counts reflect the degree of stress to which hens are subjected. Further work would be required to establish this technique as a practical means of measuring stress.

ABSTRACT

Laying pullets were maintained under four housing conditions: in a floor pen, in $6'' \times 8''$ cages, and in $10'' \times 16''$ cages at the rate of one and two pullets per cage. Studies of leukocyte counts revealed small but non-significant changes in the percent of certain cell types in association with the degree of confinement.

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تأثير التحديد المكاني على خلايا الدم البيضاء للدجاج البيوض

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المستخلص

إن نتائج هذا البحث الأولى أظهرت تبدلات طفيفة في نسب بعض خلايا الدم البيضاء عند تعرض الدجاج البيوض (اللكهورن الأبيض) إلى عامل التحديد المكاني . هذا وإن نتائج هذا البحث سوف يستفاد منها في إعداد بحث مطول يزداد فيه عدد الطيور وتزداد فيه مدة البحث كذلك .