Effect of water restriction on the lymphoid organs and production of broilers

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ABSTRACT

The effect of water restriction for different time intervals on lymphoid organs and production of broiler chicks was studied. The effect of water restriction on the mean thymus weight (gm) of chicks in group C (0.60±0.07) was adversely affected as the chicks in this group had significantly (P<0.05) lower weight than group D (4.09±0.70). This indicates that increased in the period of water restriction in chicks adversely affected the mean thymus weight as compared to chicks reared on ad-libitum water. The mean bursal weight (gm) of group C (0.07±0.02) was significantly (P<0.05) lower as compared to group D (1.37±0.88) indicating that water restriction of 24 hrs had affected the bursal development in the chicks. The mean spleenic weight (gm) of group C (2.64±1.49) was significantly (P<0.05) higher than groups A, B and E. The FCR values were significantly (P<0.05) different among groups in 6th week and there was non-significant (P>0.05) difference among groups with treatment of Vitamin C, Vitamin E and glucose treated groups.

Key words: Bursa of fabricius, FCR, Glucose, Spleen, Thymus, VC and VE, Water and Weight.

INTRODUCTION

Poultry industry is an important segment of livestock, emerged as a cheap source of protein for consumption by humans. In Pakistan, the commercial broiler farming was initiated in the early 1960’s with the import of Shaver broiler chicks (Qureshi, 1993). Ever since, the industry is progressing and growing at a rate of about 10 percent per annum and the present share of poultry meat in overall meat and beef consumption at national level is around 35 percent. This industry in Pakistan consists of over 25 thousand commercial farms, 200 chick hatcheries, and 120 Feed Mills, generating employment for about 1.5 million people. The current investment in Poultry industry is around Rs. 320 billion, and it is regarded as a vital source of eggs and meat for the common man. The present poultry production figures are estimated at 425.92 million day old chicks, of which 407.77 million are broiler chicks, which provide 501.31 metric tons of poultry meat per annum. (Anonymous, 2008-09).

Water is one of the important nutrients which is consumed in greater quantity than any of the other nutrients. Birds may die rapidly by the lack of water as compared to lack of any of the other nutrients. For an optimal growth the birds should have free and convenient access to water. The body requirement of water
varies with the age, health status, ambient temperature and the reproductive status of birds. In poultry production water is needed for sustaining the life of birds, to reduce air temperature (includes evaporative cooling pad and fogging systems), and to clean, wash and sanitize the farm premises.

Chickens are able to survive much longer without feed than without water (Katanbaf et al., 1989). A rule of thumb for water is that the bird consumes from 1.5 to 2 times as much water as it does feed (Kellems & Church, 2002).

In the poultry farming, various vitamin preparations are available and prescribed for alleviating the stress on birds (Tibiletti, 1993). Vitamin E is fat soluble and is essential for maintaining the integrity and optimal functioning of the muscular, circulatory, nervous and immune systems (Gershwin et. al., 1985).

Vitamin C is also prescribed as an anti-stressor for the improvement of growth, feed efficiency, immune responses, and livability performance of birds (Muneer et al., 2001).

In Pakistan, the importance of clean and salt-free water for poultry is usually overlooked by the farmers and provision of unhygienic water to the poultry flocks is a common practice in the field conditions. The present work will further help the farmers to realize the importance of the factor in maintaining and improving the overall health status of poultry.

MATERIALS AND METHODS

The effect of water restriction on the performance of broiler chicks was evaluated by rearing a total of 400, Hubbard X Hubbard chicks. All the experimental chicks were assigned randomly to five experimental groups i.e. A, B, C, D and E, each group consisting of 80 chicks. The chicks were separately housed and were offered the commercial broiler feed and water. The experimental chicks in the group A, B, C and E were reared at water restriction for 6, 12, 18 and 24 hrs/day and then offered water for 24 hrs (alternatively); those in group D were offered water ad libitum. The chicks received vaccination Infectious Bronchitis (IB), Newcastle Disease (ND); Infectious Bursal Disease (IBD) and Hydro-pericardium Syndrome (HPS).

At the age of day 50th lymphoid organs such as bursa of Fabricius, thymus, and spleen of both live and dead birds in each experimental group were removed and observed for morphometric analysis. At the age of day 56th, the experimental chicks were again slaughtered and weight of above referred lymphoid organs was recorded. These organs were excised and cleared off the fat and extraneous tissue material, each organ was separately weighed on an analytical weighing Sartorius Balance and a group organ mean weight was determined.

To observe the effect of various anti-stressors, each experimental group (A, B, C and D) were further sub divided in three sub-groups. The vitamins and glucose treatment were continued from days 36th to 56th and of the 03 subgroups in each experimental group (A1, A2, A3; B1, B2, B3; C1, C2, C3 and D1, D2, D3). These vitamins and glucose were administered via the drinking water as per recommended dosage level of VC 350mg/L, VE 250mg/L and glucose 1gm/L in drinking water. The control chicks in group E did not receive any of the vitamins
or glucose. The FCR values of each experimental group were calculated at the age 6, 7 and 8 weeks using the following formula described by Singh & Panda (1992).

The data obtained through the experiment was analyzed using analysis of variance and the statistical differences among the various treatment means were determined using the Least Significant Difference (LSD) test at 05% probability level according to the method described by Steel & Torrie (1980).

RESULTS AND DISCUSSION

Water is a necessary agent in all body processes and is the most critical nutrient for the production of poultry. It serves to soften and hydrolyze feedstuff for digestion. Water consumed by the bird is used for nutrient transportation, enzymatic and chemical reactions in the body, body temperature regulation and lubrication of joints and organs. It is eliminated by the bird through feces and respiration.

1. Effect of Water Restriction on the Lymphoid Organs of Chicks

I. Thymus. This investigation indicated significant (P ≤ 0.05) differences in the mean thymus weight among groups. Chicks in group D (4.09±0.70) gained significantly (P ≥ 0.05) higher mean thymus weight than groups A (1.75±0.58), B (0.65±0.08) and C (0.60±0.07) while group E (0.49±0.03) had significant (P ≥ 0.05) lower mean thymus weight than the chicks belonging to groups A, B, C and D (Table 1).

II. Bursa of Fabricius. The chicks in group D (1.37±0.88) gained significantly (P ≤ 0.05) higher mean bursal weight than A (0.69±0.12), B (0.27±0.06) and group E (0.23±0.12) while group C (0.07±0.02) had significantly (P ≤ 0.05) lower mean bursa weight than those of all other groups i.e. A, B, D and E (Table 1).

III. Spleen. There were non-significant (P ≥ 0.05) differences in spleenic weight of groups B (0.99±0.07) and E (0.99±0.01). The chicks in group C (2.64±1.49) had significantly (P ≤ 0.05) higher mean spleenic weight than groups A (1.45±0.22), B (0.99±0.07) and E (0.99±0.01). The mean spleenic weight of the water restricted chicks in the groups A and B was significantly (P ≤ 0.05) lower than the chicks in group D (Table 1).

Pires et al. (2007) reported that water deprivation in post hatching between 48 and 72 hours of age decreased spleenic weight but bursal weight was not affected in broilers which are not in agreement with the findings of present work.

Offiong et al. (2003) reported decreased spleenic, liver and heart weight in 6-8 hours water deprivation daily in broiler chicks. Negative effect of post hatching water deprivation on liver weight in broiler was also reported by Maorka (2002).
Table 1: Morphometry of Lymphoid Organs of Water Restricted and Unrestricted Chickens

<table>
<thead>
<tr>
<th>Groups</th>
<th>Body weight (gm)</th>
<th>Thymus Weight (gm)</th>
<th>Bursa Weight (gm)</th>
<th>Spleen Weight (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± S.E</td>
<td>Mean ± S.E</td>
<td>Mean ± S.E</td>
<td>Mean ± S.E</td>
</tr>
<tr>
<td>Group-A</td>
<td>1466.56±9.89b</td>
<td>1.75±0.58b</td>
<td>0.69±0.12b</td>
<td>1.45±0.22c</td>
</tr>
<tr>
<td>Group-B</td>
<td>1398.87±10.21c</td>
<td>0.65±0.08c</td>
<td>0.27±0.06c</td>
<td>0.99±0.07d</td>
</tr>
<tr>
<td>Group-C</td>
<td>1444±10.55c</td>
<td>0.60±0.07c</td>
<td>0.07±0.02d</td>
<td>2.64±1.49c</td>
</tr>
<tr>
<td>Group-D</td>
<td>1534.25±14.85a</td>
<td>4.09±0.70a</td>
<td>1.37±0.88a</td>
<td>2.06±0.14b</td>
</tr>
<tr>
<td>Group-E</td>
<td>1489.12±10.50b</td>
<td>0.49±0.03d</td>
<td>0.23±0.12c</td>
<td>0.99±0.01d</td>
</tr>
</tbody>
</table>

Groups = Group A, water restriction for 12 hrs; group B, water restriction for 18 hrs, group C, water restriction for 24 hrs and ad libitum water for 24 hrs, alternatively; group D, no water restriction (ad libitum water available throughout experimental period) and group E, water restriction for 6 hrs.

Any two means carrying the same superscript are not significantly different from each other at 5% probability level using LSD test.

2. Effect of Water Restriction on the Feed Efficiency of Chicks

In the first week of their age, birds in all experimental groups had same FCRs (1.58±0.08) indicating no effect of any type on their feed conversion efficiency. However, in the 6th week of their age, the effects of water restriction on FCR were quite evident. The mean FCR values at week 6 of age of chicks in the experimental groups A, B, C, D and E were recorded as 2.37±0.04, 2.50±0.09, 2.38±0.14, 2.25±0.07 and 2.42±0.07, respectively, indicating that the water restriction in chicks caused poor FCR as compared to the birds reared under ad libitum water availability. The differences in the FCR values of chicks in various groups were significant (P ≤0.05) at the age of 6 wks. The use of vitamin C, vitamin E and glucose did not indicate any improvement in FCR values of the treated groups (Table-2).

In the 7th week the effect of VC showed significant differences among groups and group B (2.58±0.16) has significantly high FCR than group A (2.38±0.03) and C (2.38±0.09). The effect of VE showed significant (P ≤ 0.05) differences among groups A (2.37±0.05), C (2.46±0.09), D (2.28±0.18) and E (2.66±0.12). The treatment of glucose showed no differences between groups B (2.58±0.08) and C (2.50±0.09) but differences in groups A (2.33±0.05) and E (2.68±0.15). In 8th week the effect of VC showed no significant differences in groups A (2.44±0.08) and C (2.49±0.06) but differences from groups B (2.60±0.07) and E (2.65±0.11). The effect of VE showed no differences in groups A (2.42±0.17) and C (2.54±0.02) but significant (P ≤ 0.05) differences from groups C (2.58±0.13) and E (2.67±0.17). The effect of glucose showed no significant differences in groups B (2.65±0.15) and E (2.63±0.04) but significant (P ≤ 0.05) differences from group A (2.47±0.23) (Table-2).
Table 2: Weekly Body Weight/FCR (Mean ± S.E) of Birds of Water Restriction Stress and Control Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>6th Week</th>
<th>7th Week</th>
<th>8th Week</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Vitamin C</td>
<td>Vitamin E</td>
<td>Glucose</td>
</tr>
<tr>
<td></td>
<td>Weight (FCR)</td>
<td>Weight (FCR)</td>
<td>Weight (FCR)</td>
</tr>
<tr>
<td>Group A</td>
<td>1466.56±9.89 (2.37±0.04)</td>
<td>1543.75±12.45 (2.38±0.03)</td>
<td>1520±10.09 (2.37±0.05)</td>
</tr>
<tr>
<td>Group B</td>
<td>1398.87±10.21 (2.50±0.09)</td>
<td>1472.50±11.10 (2.58±0.16)</td>
<td>1380±10.11 (2.60±1.41)</td>
</tr>
<tr>
<td>Group C</td>
<td>1444±10.55 (2.38±0.14)</td>
<td>1520±11.20 (2.38±0.09)</td>
<td>1478±12.35 (2.46±0.09)</td>
</tr>
<tr>
<td>Group D</td>
<td>1534.25±14.85 (2.25±0.37)</td>
<td>1615±15.21 (2.31±0.18)</td>
<td>1500±2.35 (2.42±0.11)</td>
</tr>
<tr>
<td>Group E</td>
<td>1489.12±10.50 (2.32±0.07)</td>
<td>1567.50±9.35 (2.35±0.09)</td>
<td>1660±12.35 (2.42±0.12)</td>
</tr>
</tbody>
</table>

Groups A = Group A, water restriction for 12 hrs; group B, water restriction for 18 hrs; group C, water restriction for 24 hrs and ad libitum water for 24 hrs, alternatively; group D, no water restriction (ad libitum water available throughout experimental period) and group E, water restriction for 6 hrs.

*Chicks note given treatment with Vitamin. C, Vitamin. E or glucose

a, b, c, d Any two means carrying the same superscript are not significantly different from each other at 5% probability level using LSD test.
The findings of present study are different from Offiong, et al. (2003) who reported no significant changes in FCR in chicks that were water deprived daily for 6-8 hrs.

REFERENCES


