

## Bursa of Fabricius and Thymus and its Relation to Egg Production

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**B**URSA of fabricius gland and thymus gland oil extraction and dried material were fed for laying hens in the rate of 1.5 ml injection weekly of the oily extract that equals 5 g of fresh gland either of bursa or thymus, 1 g of dried bursa that equals 5 g of fresh gland, 2 g of thymus that equals 4 g of fresh gland. Also double administration of both injections and dried materials was done for both glands.

Bursa treatments reduced egg number, percentage egg production and average egg mass weight, while increased egg weight. Thymus treatments with injections alone or with double administration of injections and dried gland increased egg number, percentage egg production and average egg mass and average egg weight. The dry material administration reduced all the items studied.

Most of studies done on the bursa of fabricius (Glick, 1954) and thymus (Ross, *et al.*, 1955) glands dealt with their relation to either growth or viability of birds. Meanwhile few studies were done to clear its relation with egg production.

### *Bursa of fabricius*

Testes size increase slowly during the period of most rapid of bursa growth while they increased at a greater rate during the regression period of bursa, indicating a negative relative between the bursa and the reproductive organs. However, testes size was markedly reduced in the bursaectomized birds at 6 and 10 weeks of age showing a direct relation between the bursa and the growth of the different parts of the body at the young ages (Glick, 1954). Testosterone propionate also reduce bursa size. The bursa of caponized birds were heavier than those of the controls (Glick, 1955). Negative correlation between the bursa size and adrenal activity were found in birds at 7 weeks of age indicating another evidence of its inhibiting factor for reproduction and related hormones and characters (Glick, 1960). In general, it can be suggested due to different references that the major part of bursa of fabricius is to produce antibody in birds and it is the main supply of these antibodies in birds and the spleen comes in a minor part in this respect (Jaap, 1960).

### *Thymus*

Neither thymusectomy nor injections of thymus material had any effect on age at sexual maturity and the injections of thymus extracts significantly highest rate (Berry and Payne, 1961).

### Material and Methods

#### Experiment No. (I)

##### *Materials*

The bursa of fabricius of about 2000 chickens males and females 2-4 months age were collected from automatic poultry slaughter house. These glands weighed 700 g after dissection and discarding all fibrous and fatty tissues around them.

The glandular tissue was then minced in an electric mixer and freeze-dried until exposed to the extraction process. Petroleum ether, then acetone were used in Soxhler apparatus for extraction of all fatty and proteic constituents in the bursal tissue. The oily extract was collected evaporated and weighed (about 220 g) and the proteinous extract separated was found about 10 g. The oily extract was sterilized into vials by sterilizing in an autoclave for 3 successive days and stored in a refrigerator until used.

The residual tissue after extraction by petroleum and acetone was collected and weighed (about 150 g), then desiccated in a glass desiccator phosphorus pentoxide for water absorption where it was left for about two weeks. The tissue was then dried in an electric oven at 40°C for 3 successive days. The dried tissue together with the extracted proteinous material, were then ground in an electric grinder, and the powder was capsulated in gellatinous capsules each containing 0.5 g of the dried residual tissue.

##### *Methods*

About 150 laying hens of about the same age (12 months) from the experimental farm of the Faculty of Agriculture, Cairo University, were put under observation and their egg production (egg wt and No.) was recorded. From this group of laying hens 40 hens were selected, as being of the same egg laying capacity and egg production. These 40 hens were divided into 4 groups, adjusted to be nearly of the same group weight and egg production. All experimental hens were put under the same environmental conditions of housing and fed the same ration composed of 20% corn gluten, 20% extracted rice bran, 18.5% wheat bran, 10% starch by products, 5% decorticated cotton seed cake, 2% bone meal, 1.5% calcium carbonate, 0.5% salt and 3% mineral salt mixture. 5% of all ration fish meal was added. Green fodder was supplied all the year. Antibiotics and vitamin mixtures were supplied all the year. All the groups were fed and treated alike.

Eggs produced from these experimental groups were recorded individually (egg wt. and No.) for one month before the start of administration of the glandular tissue, being a control period for these experimental birds. Treatment then started as follows :

*Group 1* : Hens were given periodic injections 1.5 ml of the sterile oily extract intramuscularly in the thigh region. This dose is extracted nearly of about 5 fresh glandular tissue. Injections were given for one month at intervals of 3-5 days to give the chance for complete absorption of the oily material injected.

*Group 2* : The experimental birds were administered each periodically 1 of the dried powdered residual tissue with the proteinous extract, in the form of two capsules each containing 0.5, equivalent to about 5 of the fresh glandular tissue. These capsules were given at the same intervals as the oily injections in group 1 for one month experimental period.

*Group 3* : The hens of this group were given a doubled administration of the oily extract and the powdered residues. Each was given an injection of 1.5 ml of the oily matter intramuscularly in the thigh region and two capsules of the dried residues (one) per 0.5. This administration was given periodically at interval of 3-5 days for one month experimental period.

*Group 4* : This group was left untreated under the same environmental and nutritional conditions, as a control group. Each hen of this group was given two empty capsules at the same periodical interval as the other groups, so as to be sure that any effect is not related to the gellatiness material of the capsules.

During this period of treatment, the egg weight and egg number of each hen alone was recorded and then collected as groups.

The experimental laying hens were again weighed after the last administration of glandular tissue and then again after two weeks to determine any changes which may have taken place in body weight as a result of this treatment.

At the end of the experiment these records were collected and tabulated in tables comprising egg number per month, percentage of egg production, average egg wt. and egg mass, before and during the experimental treatment period.

#### Experiment No. (2)

##### *Materials*

The thymus glands of 10 buffalo calves about 6 months age were collected from the central Cairo slaughter house. These glands were dissected to discard the surrounding fat and fibrous tissues. About 500 g of pure glandular tissue were separated.

The glandular tissue was then minced in an electric mixer and freeze-dried until exposed to the extraction process. Extraction was carried on in a Soxhlet's apparatus using petroleum ether and acetone consequently for extraction of all the fatty and proteinous constituents of these thymus glands. The oily extract was collected, evaporated and weighed (about 145 g). It was sterilized in an autoclave after being collected in vials, by steaming for one ½ hr for 3 successive days, then stored in a refrigerator until used. The proteinous residues separated formed about 10 g of the extract which was added on the residual matter after extraction.

The residual matter collected weighed about 240 g, desiccated in a glass desiccator for about two weeks using phosphorus pentoxide. The tissue was then dried in an oven at 40°C for 3 successive days.

The dried tissue together with the extracted proteinous material were ground in an electric grinder, and the powder was capsulated in gelatinous capsules each containing 0.5 g of the dried tissues.

#### *Method*

About 200 laying hens of the same age (12 months) from the experimental farm of the Faculty of Agriculture, Cairo University, were put under observation and their egg production (egg wt. and No.) was recorded. From these collections of laying hens, 40 birds were selected, as being of the same laying capacity and egg production.

The 40 experimental hens were divided into 4 groups, adjusted to be nearly of the same group weight and egg production. All birds were put under the same environmental and nutritional conditions and fed the same ration composed of 20% corn, 20% gluten, 20% extracted rice bran, 18.5% wheat bran, 10% starch by products, 5% decorticated cotton seed cake, 2% bone meal, 1.5% calcium carbonate, 0.5% salt and 3% mineral salt mixture. 5% of oil ration fish meal was added. Green fodder was supplied all the year. Antibiotics and vitamins mixtures were supplied. All the groups were fed and treated alike.

Eggs produced from these experimental groups were recorded individually (wt and No.) for one month before the start of administration of the glandular tissue, as a control period. Treatment then started as follows :

*Group 1 :* Hens were given periodic injections 1.5 ml of the sterile oily extract, intramuscularly in the thigh region. This dose is extracted nearly from about 5 g fresh thymus tissue. Injections were given for one month or intervals of 3-5 days to give chance for complete absorption of the oily material injected.

*Group 2*: The experimental birds were administered periodically, one of each of the dried powdered residual tissue with the proteinous extract, in the form of four capsules each containing 0.5 g (2g dose) which is equivalent nearly to about 4 g fresh glandular tissue. Thus capsules were given at the same intervals as the oily injections in group 1 for one month experimental period.

*Group 3*: The hens of this group were given a doubled administration of oily extract and the powdered residues. Each was given an injection of 1.5 ml. of the oily matter intramuscularly in the thigh region and four capsules of the dried matter (2g) per. This administration was given periodically at interval of 3-5 days for one month experimental period.

*Group 4*: This group was left untreated under the same environmental and nutritional conditions, as a control group. Each was given four empty capsules of the same periodical intervals as the other group to exclude any effect that may be related to these gelatinous capsules.

During this period of treatment, the egg wt and No. of each hen alone was recorded and then collected as groups.

The experimental laying hens were again weighed after the last administration of glandular tissue and then again after two weeks to determine any changes which may have taken place in body wt. as a result of this treatment.

At the end of the experiment, these records were collected and tabulated in tables comprising egg No. per month, percentage egg production, average egg wt. and egg mass, before and during the experimental period of treatment.

#### *Bursa of fabricius*

It is evident from Table 1 that all the bursa treatments reduced egg production either in number of eggs and percentage production or in average egg mass weight. This reduction was reversed in respect to egg weight as the different treatments increased egg weight over the control. This is a well known fact that there is a negative relationship between egg number and egg weight in the production of eggs.

The rate of reduction and response differed according to the administration method of the bursa. The highest reduction was observed when both the injection of 1.5 ml of oily extract of the bursa plus giving two capsules

of 0.5 g each weekly for each hen. When the injections and the capsule administration methods were compared, the administration of capsules reduced egg production more than the injection irrespection to that both gave the bird the same amount of fresh gland.

This indicates that the bursa gland plays its role mainly during the growth period and then in degenerate. The reactivation of the role of this gland after the sexual maturity stage cause the inhibition of the reproductive phenomenon as an antigenestic factor for reproduction.

TABLE 1. The effect of bursa of fabricius on egg production characteristics.

| Items         | Control                      | Treatments |       |       |      |
|---------------|------------------------------|------------|-------|-------|------|
|               |                              | 1          | 2     | 3     |      |
| Egg No./month | —Before . . . . .            | 8.6        | 8.6   | 6.9   | 9.1  |
|               | —During . . . . .            | 16.2       | 15.4  | 12.3  | 5.4  |
|               | —% Dif . . . . .             | 88.2       | 80.0  | 78.2  | 40.7 |
|               | —Dif% to control . . . . .   | 100.0      | 90.9  | 89.0  | 46.1 |
| % Production  | —Before . . . . .            | 28.6       | 28.6  | 23    | 30.3 |
|               | —During . . . . .            | 54.0       | 51.3  | 41.0  | 18.0 |
|               | —% Dif . . . . .             | 25.4       | 22.7  | 18.0  | 12.3 |
|               | —Dif. % to control . . . . . | 100.0      | 89.5  | 79.0  | 48.4 |
| Av. Egg wt.   | —Before . . . . .            | 40         | 38    | 37    | 38   |
|               | —During . . . . .            | 44         | 44    | 45    | 45   |
|               | —% Dif . . . . .             | 10.0       | 15.8  | 21.6  | 19   |
|               | —Dif.% to control . . . . .  | 100        | 150   | 200   | 175  |
| Av. Egg mass  | —Before . . . . .            | 344        | 327   | 255   | 346  |
|               | —During . . . . .            | 713        | 678   | 566   | 653  |
|               | —% Dif . . . . .             | 107.3      | 107.3 | 118.0 | 88.7 |
|               | Dif. % to control . . . . .  | 100.0      | 95.0  | 81.3  | 83.1 |

TABLE 2. The effect of thymus on egg production characteristics.

| Items                          | Control | Treatments |       |       |
|--------------------------------|---------|------------|-------|-------|
|                                |         | 1          | 2     | 3     |
| Egg No. month—Before . . . . . | 6.0     | 6.7        | 8.3   | 4.6   |
| —During . . . . .              | 12.9    | 14.6       | 15.1  | 14.6  |
| —% Dif . . . . .               | 115.0   | 118.0      | 82.0  | 218   |
| —Dif.% to control . . . . .    | 100     | 114.5      | 98.5  | 145   |
| % Production —Before . . . . . | 20      | 22.3       | 27.7  | 15.3  |
| —During . . . . .              | 43.0    | 49.0       | 50.3  | 49.0  |
| —% Dif . . . . .               | 115.0   | 120.0      | 81.6  | 220.3 |
| —Dif. % to control . . . . .   | 100.0   | 116.0      | 98.0  | 146.5 |
| Av. Egg wt. —Before . . . . .  | 39      | 40         | 37    | 37    |
| —During . . . . .              | 45      | 46         | 43    | 44    |
| —% Dif . . . . .               | 15.4    | 15.0       | 16.2  | 19.0  |
| —Dif.% to control . . . . .    | 100.0   | 100.0      | 100.0 | 116.6 |
| Av. Egg mass —Before . . . . . | 234     | 268        | 307   | 170   |
| —During . . . . .              | 581     | 672        | 649   | 642   |
| —% Dif . . . . .               | 148.3   | 158.2      | 111.6 | 278.0 |
| —Dif. % to control . . . . .   | 100.0   | 116.5      | 70.0  | 136.0 |

*The thymus*

The normal role of thymus is not known until now. Few studies dealt with its relationship with growth as growth activator (Ross, *et al.*, 1955 and Berry and Payne, 1961). However, in these few studies negative relation was found between thymus extract and egg production (Barry and Payne, 1961).

In this study, it seems that the administration method had reversed the previously known facts about this gland. The injection of the oily extract increased the number of eggs produced per hen per month, percentage production and average egg mass weight. This effect was increased and these items increased greater than that when these injections of the oily extracts of thymus was supported by 4 capsules of thymus dried material giving 4 g of fresh gland of 2 g of dried material. However, the administration of the dried thymus alone reduced all the previous characters. This may be the cause of the previous results in the review as mostly they used dried thymus glands. All the treatments has no effect on egg weight except when the thymus was given in the two forms and in a double quantity.

Further studies with respect to these two glands to determine chemically the nature of their extraction and also their role on other productive and reproductive characters are needed.

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## تأثير غدة البرسا والشيوسية على انتاج البيض

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بعد تجفيف مستخلص الغدد واعطاؤه للدجاج البياض ووجد أن اعطاء البرسا أدى الى انخفاض انتاج البيض وزاد من وزنه . وحقن الثيموس لوحده أدى الى زيادة انتاج عدد البيض ووزنه .