OSTEOPOROSIS, CAGE LAYER FATIGUE AND POOR SHELL QUALITY: PREVENTION RATHER THAN CURE

Osteoporosis, cage layer fatigue and poor shell quality have a common cause, i.e., insufficient available calcium for the support of bone metabolism or egg shell deposition. Osteoporosis is a condition in which the structural components of bones become abnormally thin. Osteoporosis can result in excessive bone breakage when spent cage layer flocks are caught and processed. Hens with cage layer fatigue have trouble standing and typically crouch or lie at the back of the cage. Severely affected hens may die due to inability to reach food or water. The condition arises from bone weakness in high-producing hens leading to fractures of thoracic vertebrae. The fractures impair function of the lower spinal cord, causing leg paralysis. Poor shell quality occurs most commonly in older flocks and is caused primarily by insufficient shell material being deposited on eggs. Excessive shell weakness leads to loss of income due to egg cracks and breakage.

The skeleton functions as a calcium reserve into which a hen deposits dietary calcium for storage and from which it takes calcium for use in egg shell formation. During the first cycle of production, a high-producing hen puts over 25 times as much calcium into egg shell as it has in its skeleton at any one time. Since the skeleton has to be maintained, virtually all of the calcium required for egg formation must be obtained by means of daily feed intake.

Egg shell formation occurs mostly at night when hens are not eating. Therefore, calcium cannot simply be transferred from the intestines after being absorbed from food to the uterus to be laid down as egg shell. The hen uses a special type of bone called medullary bone to store calcium for several hours until it is time to form an egg shell (Etches, 1987). Medullary bone occupies empty spaces such as the marrow cavity in the long bones, pelvic girdle, and ribs of a mature hen. It adds little strength to the skeleton. Medullary bone does not occur in immature pullets or in males of any age but develops in pullets as they become sexually mature.

The hen appears to have a neat solution for the timely supply of calcium for egg shell formation. Problems arise, however, when too little calcium is obtained from the diet to support ongoing egg production. This can happen in various ways.

- The calcium content of the ration may not be increased soon enough when pullets begin egg production.
- A heat wave or sub-clinical disease may reduce feed consumption for a few days while egg laying continues, or subordinate hens in crowded, competitive cage environments may eat less than the flock average feed consumption.

PUTTING KNOWLEDGE TO WORK

The University of Georgia and Ft. Valley State College, the U.S. Department of Agriculture and counties of the state cooperating.

The Cooperative Extension service officers educational programs, assistance and materials to all people without regard to race, color, national origin, age, sex or disability.

An equal opportunity/affirmative action organization committed to a diverse work force.
• Older hens may have reduced ability to absorb dietary calcium that cannot be compensated by increased calcium percentage in the ration.
• A dietary deficiency of phosphorous can prevent adequate deposition of calcium into medullary bone.

Inadequate calcium supply creates a conflict between structural bone maintenance and egg shell formation. The result is largely a one-way street with calcium being transferred from structural bone to medullary bone from which it is subsequently released for egg shell formation. Osteoporosis develops.

Hens have little ability to reverse osteoporosis while they remain in lay (Whitehead and Wilson, 1992). Successive events of calcium deficiency add to the severity of osteoporosis and increase likelihood of fragile bones or cage layer fatigue. Given the limited amount of skeletal calcium relative to the daily calcium demand of an egg laying hen, it does not take much of a dietary calcium deficiency to exhaust the skeletal calcium which can be made available for shell formation. A hen obtaining too little calcium from dietary and skeletal sources will produce poor quality egg shells if she remains in production.

Pullets must be prepared to handle the calcium demand associated with high egg output.
• Optimum skeletal frame size should be achieved before a pullet flock is brought into production because the amount of bone material determines the capacity of a hen to store and release calcium for shell formation. Since skeleton size is closely associated with body weight it is usually sufficient to weigh pullets during the growing period to determine how close they are to target body weights. Photostimulation should be delayed for a flock which is slow to achieve its final target body weight.
• Pullet flocks should be grown in the best environments possible to maximize flock uniformity. A non-uniform flock will have too many overweight or underweight pullets when brought into production. Overweight pullets may mature before calcium is increased in the ration. Underweight pullets will have undersized skeletons. Pullets in either weight extreme have increased risk of osteoporosis, cage layer fatigue or poor shell quality.
• The level of calcium in the ration should be increased as soon as sexual maturation begins because growth of medullary bone also begins at this time. Flock supervisors should be alert for the enlargement and reddening of the comb that indicates the start of sexual maturation. Some producers feed a prelay diet until a flock reaches five percent production. Prelay rations have enough calcium to support medullary bone development but not enough to support a high rate of egg production. It should be understood that this practice puts at risk the earliest producing birds in the flock.

Once in lay, a flock should be managed to avoid problems that could affect calcium metabolism. The program of feed formulation, milling and delivery should provide for calcium and phosphorous requirements without fail. The thermal environment in the layer house should be uniform so that the nutritional needs of all hens can be targeted as accurately as possible. Biosecurity and proper disease management should be applied to minimize effects of illness on the nutritional status of birds.

In summary, commercial layers should be managed to prevent osteoporosis and poor shell quality because these problems do not lend themselves to correction once they occur.

A. Bruce Webster  
Extension Poultry Scientist

County Extension Director/Agent

References:

**Consult with your poultry company representative before making management changes.**