



**North Carolina  
Cooperative Extension Service**  
NORTH CAROLINA STATE UNIVERSITY  
COLLEGE OF AGRICULTURE & LIFE SCIENCES

POULTRY SCIENCE

# FACTS

## Specific Gravity Determination for Hatching Eggs

### The Purpose of Performing a Specific Gravity Analysis

Specific gravity determinations are a non-invasive method to determine eggshell thickness, and therefore eggshell quality. Specific gravity determinations also have the advantage of being simple, easy to perform, and inexpensive. Specific gravity reflects the amount of shell present relative to the amount of albumen, yolk, and membranes. It can be used by the poultry industry to assess shell quality of hatching eggs as the hen ages or during periods of stress which may affect shell quality<sup>2,3</sup>. Specific gravity measurements have shown to decrease after approximately forty five weeks of age<sup>1</sup>. While it is expected that specific gravity will decrease with age of flock, sometimes the use of this procedure will allow one to know when specific gravity falls below an expected level. It will allow one to quantitate the shell quality of a flock at any particular age which may be having a problem and to also evaluate the effectiveness of a treatment used to improve shell quality. It has been shown that hatchability of thin shelled eggs (<1.080) was at least two percent less than thicker shelled eggs in hens of the same age and had a higher incidence of embryonic death<sup>1</sup>.

The specific gravity of an object equals the weight of its volume relative to the weight of an equal volume of water, when both are at the same temperature. The specific gravity of an egg is equal to the egg's density relative to water. An egg has four basic parts: yolk,

albumen, shell membranes, and shell. The specific gravity of all four parts of the egg are different (shell, 2.325; yolk, 1.032; albumen, 1.038; shell membranes, 1.075)<sup>4</sup>. Since the specific gravity of the shell is more than two times higher than the other parts of the egg, the percentage of egg that is shell has a major influence on the specific gravity of the whole egg. As the amount of shell increases, the specific gravity of the egg increases, and corresponding changes in the proportions of yolk, albumen, and shell membranes will be of little consequence. Egg specific gravity, therefore, is a good indicator of percentage shell and is the reason specific gravity is used to determine shell quality. At times a breeder manager or hatchery manager may wish to assess the status of egg shell quality for a particular flock or flocks.

To perform the specific gravity determination, you immerse the egg in a series of increasingly concentrated salt solutions until the egg floats on the surface of one of the solutions. Specific gravity is highly related to the incidence of breaks and cracks. The incidence of breakage is above normal if the specific gravity of a flock averages less than 1.080. It should be adequate that we use two to three salt solutions to give us an estimation of the specific gravity of a flock's eggs.

### Equipment Required to Perform Specific Gravity Determinations

1. 3 plastic 5 gallon containers with sealable lids, or 3 plastic dish pans
2. Feed grade or all-purpose non-iodized salt

3. 1 hydrometer with a specific gravity range of 1.050-1.100
4. 1 glass or clear plastic graduated cylinder for use with the hydrometer (must be taller than the hydrometer)
5. 1 perforated bucket or a plastic egg flat to immerse the eggs in the salt solutions
6. Egg flats for each of the four levels of specific gravity determinations

### The Specific Gravity Procedure

The day before the measurements are performed a minimum of 100 fresh eggs should be randomly selected from the flock. Avoid selecting only the better or poorer eggs from the flock. The eggs selected and the water to make the solutions should be placed in the room where the measurements will be performed the day before the test. This will allow all materials for the test to reach the same temperature overnight.

On the day of the determination, the salt solutions should be made. To make the salt solutions, add the corresponding amount of salt to the properly labeled plastic bucket containing 5 gallons of fresh, clean water (Table 1). The amounts given below are computed on the basis of one gallon, as some may prefer to use a dish pan to perform the test, which holds a lesser amount of water.

<u>Solution Level</u>	<u>Lbs. Salt/Gallon of Water</u>
1.070	0.8
1.075	0.9
1.080	1.0

You may wish to make a concentrated salt brine solution and then add appropriate amounts of water to arrive at the correct specific gravity solution. Be sure that the salt brine and the water are the same temperature.

These three solutions will yield four specific gravity groups: Less than 1.070, 1.070-1.075, 1.075-1.080, and greater than 1.080.

Once the solutions have been made, they must be adjusted by using the hydrometer. The graduated cylinder is filled with a sample of each salt solution and the hydrometer is then placed in the graduated cylinder. The specific gravity of the solution should be read from the bottom of the meniscus for consistency. If the reading is higher than desired, place the solution from the hydrometer back into the 5 gallon bucket and add a small amount of water. Stir thoroughly and test again. Repeat if necessary. Conversely, if the reading is lower than desired, return the solution from the hydrometer back into the 5 gallon bucket and add a small amount of salt. Stir thoroughly, and repeat the test. Keep adding salt until you obtain the specific gravity you desire.

The perforated plastic bucket or the plastic egg flat may be used to lower the eggs into the solutions, starting with the lowest specific gravity solution and continue to the higher. If the egg floats in that solution, it should be removed to a flat correspondingly labeled to the appropriate specific gravity level. Table 2 demonstrates how to classify eggs into 4 different specific gravity groupings. Since you are using a sample of 100 eggs, the percentage of eggs at each specific gravity level can be easily determined simply by counting the number of eggs in that specific gravity range. After the procedure is finished, the eggs may be rinsed with an egg sanitizer solution, allowed to dry, and used normally.

**Table 2**

<u>Specific Gravity of Solution</u>	<u>Floating (F) or Sinking S Action of Egg</u>
1.070	F less than 1.070 S greater than 1.070
1.075	F between 1.070 and 1.075 S greater than 1.075
1.080	F between 1.075 and 1.080 S greater than 1.080

### Points to Remember

- Specific gravity measurements should be taken within 24 hours after the eggs are laid. Consistent timing of specific gravity determinations are important for reliable results which can be used to compare one trial with another. Moisture loss will reduce specific gravity measurements.
- The salt solutions can be sealed and reused, but must be rechecked for accuracy prior to subsequent use. Adjustments will be necessary each time they are used.
- Specific gravity determinations should be performed the same way each time they are done. This permits an accurate comparison of scores over time, giving the breeder manager valuable information about the flock.
- The specific gravity readings will not be accurate if the temperatures of all materials have not been allowed to equilibrate overnight. Accurate specific gravity readings are very dependent on both the eggs and the solutions being at the same temperature during the test.

- Always obtain a random sample of eggs for the test. If you select out samples from only one area of the house, or if you use consistently superior or inferior eggs, the results will not give you an accurate representation of the performance of your flock.

### REFERENCES

1. Bennett, Carlyle D., 1992, "The Influence of Shell Thickness on Hatchability in Commercial Broiler Breeder Flocks," *Journal of Applied Poultry Res.*, 1:61-65.
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4. Olsson, Nils, 1934. *Studies on the Specific Gravity of Hens Eggs.* Agricultural School. Hammenhog, Sweden

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