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COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF FOOD TECHNOLOGY

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MEAT, FISH AND POULTRY PROCESS TECHNOLOGY

UNIT IV – EGG PROCESSING

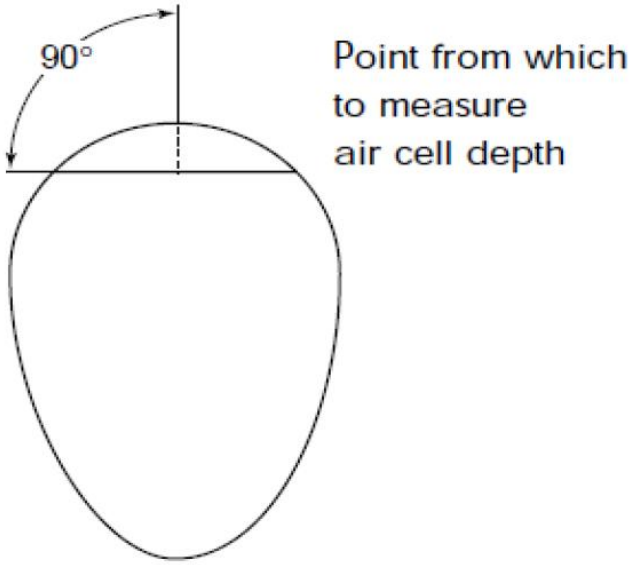
Topic: Measures of egg quality

Determining External Egg Quality:

External egg quality is measured in many ways. Among many quality characteristics, external factors including cleanliness, egg weight and shell weight. It can also measure by egg size, shell color, shell breaking strength and shell thickness are important in consumer's acceptability of shell eggs. The weight of eggs varies widely depending on many factors such as the breed, the age of the layer and environmental temperature. In Africa, the egg weight may range from 35 to 65 grams (g), while in Europe it may range from 45 to 70 grams (g). As a layer gets older the weight of the eggs increase. Direct and indirect measurement of shell strength can be considered as mechanical and physical properties of egg respectively. Direct method includes measures of shell breaking strength such as puncture force and shell weight whereas indirect methods include specific gravity, non-destructive deformation and the percentage of crack. Shell thickness is measured by millimetre (mm) using electronic digital caliber. A shell should be thick enough for the egg to with stand a reasonable amount of handling without breakage, because lower strength causes higher percentage of egg damage which increases economic losses. The color of an egg shell is determined primarily by the genetics of the hens, thus white feathered hens lay *white eggs and brown feathered hens lay brown eggs. During the process of egg shell formation, the epithelial cells lining the surface of the shell gland synthesize and accumulate pigments. In the final three to four hours of shell formation these pigments are transferred to the viscous, protein rich cuticle. The quantity of pigment in the cuticle determines the color of egg shell .

Determining Internal Egg Quality:

The internal quality of an egg is determined by the composition of egg white, yolk and possible enclosures (flesh, blood), but also by the freshness since egg starts to age directly after laying. This aging impact can be measured using either destructive or non-destructive methods. The non- destructive method assesses the size of the air chamber and the destructive method measures the height of the thick albumen, with egg content on a flat surface, the so-called HU. Albumen quality has a major influence on overall interior egg quality and it provides more protein than the yolk. Over half of the protein in whites is ovalbumin, although conalbumins, ovomucid, and globulins (including lysozyme, which is able to lyses some bacteria) contribute lesser percentages of protein in the egg whites. Thinning of the albumen is a sign of quality loss. Yolk quality is determined by the color, texture, firmness and smell of the yolk. Yolk color is a key factor in any consumer survey relating to egg quality. Consumer preferences for yolk color are highly subjective and vary widely from country to country. The primary determinant of yolk color is the xanthophylls (plant pigment) content of the diet consumed. Yolk pigments are relatively stable and are not lost or changed in cooking. Sometimes there is a greenish ring around hard cooked egg yolks due to sulfur and iron compounds in the egg reacting at the surface of the yolk. It may occur when eggs are overcooked or when there is a high amount of iron in the cooking water. Although the color may be a bit unappealing, the eggs are still wholesome and nutritious, and their flavor is unaffected. The inclusion of more than 5% cottonseed meal in a layer diet will result in olive or salmon-colored yolks while the inclusion of certain weeds or weed seeds may results in green yolks. Both inadequate mixing of the diet as well as excessive mixing of the diet will also result in a heterogeneous feed and subsequent variation in the amount of xanthophylls consumed by each hen in the flock, this will result in egg yolk color not being uniform throughout the flock. The yolk of a freshly laid egg is round and firm; however, as the egg ages and the vitelline membrane degenerates, water from the albumen moves into the yolk and gives the yolk a flattened shape. Rubbery yolks may be caused by severe chilling or freezing of intact eggs, the consumption of crude cottonseed oil or the seeds of some weeds. The depth of the air cell is the distance from its top to its bottom when the egg is held with the air cell up. In a fresh egg, the air cell is small, not more than 1/8-inch deep. As the egg ages, evaporation takes place and the air cell becomes larger and the egg is downgrade.



Official air cell gauge and method for measuring depth of air cell

Egg Quality Grading:

Egg grading is a form of quality control used to divide an egg into a number of classes based on both internal and external qualities. The purpose of the egg grading is to sort the eggs into categories based on exterior quality factors such as cleanliness and soundness of the shell and interior quality factor such as albumen, yolk, air cell and possible abnormalities. By using candling and broken-out method, grading of an egg can be done. Egg shall be graded into 3 classes namely grade AA, A and B. Grades AA and A eggs are nearly identical, the main difference being that grade A eggs are slightly older than grade AA eggs. Grade AA eggs have firmer, thicker whites that hold the yolks up high and round, whereas the white of a grade A egg is "reasonably firm," meaning it spreads a little further when you break the egg into a frying pan. Grade B eggs have stained or abnormal shells, minor blood or meat spots.

Candling: Candling is used to judge interior egg quality because external appearance is not an accurate indication of overall egg quality. Each egg is graded on its individual merits of quality according to United States Department of Agriculture (USDA). Knowledge of the parts of the egg is essential to understanding candling and grading. Candling has the advantage of being non-destructive, rapid and automated. A very simple form of candling is placing a candle in a dark room and positioning an egg in front of the flame and looking at the interior quality.

Using Candler to determine internal egg quality

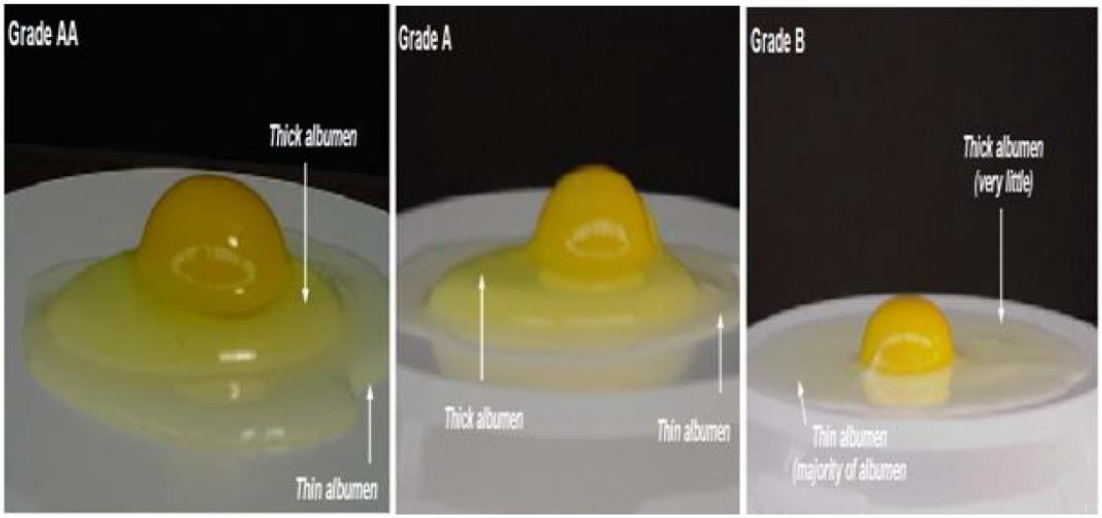
Broken-out Method: Break-out method of determining interior quality is a way for graders is develop their grading skills that enable them to make comparisons of broken out egg appearance with candled appearance. The most accepted and widely used method for determining albumen quality is measuring Haugh units. HU was calculated from two parameters; height of albumen (AH) and Egg weight (EW). To calculate HU, we can use this formula:

HU= 100 log (AH – 1.7 EW0.3) where as to calculate albumen percent we can use; albumen percent = (Albumen weight/weight of the whole egg) x 100 [38]. The higher number of HU the better quality of eggs and the values ranges from 0-130.

The HU ranked as grade AA: 72HU, A: 71-60HUand B: 59-31 HU [36]. When a fresh egg is carefully broken out onto a smooth flat surface, the round yolk is in a central position surrounded by thick albumen.

The diameter of the thick albumen (top view) may give an indication of grade; however, the height of the thick albumen (side view) is the most important factor in determining grade of an egg.

When a stale (old) egg is broken out, the yolk is flattened and often displaced to one side and the surrounding thick albumen has become thinner, resulting in a large area of albumen collapsed and flattened to produce a wide arc of liquid.



Grades of broken eggs by broken-out method

Factors	Grades		
	AA	A	B
1. Shell: -Outer shell	-Free from check -Smooth surface,	-Same as grade AA	-ridges or rough -free from check -scattered stains
2. Candling 2.1 shell	-Clean and free from inner cracks	-Same as grade AA.	- -unbroken shell -Slightly stain
2.2 Air cell	-1/8 inch or less in Depth	-3/16 inch or less in depth	-More than 3/16 inch in Depth
2.3 Albumen	-Clear Firm	-reasonably Firm	-Clear, May be weak and watery
2.4 Egg Yolk	-Outline slightly defined	-Outline well-defined	-Outline clearly visible
3. Break-out egg 3.1 Egg yolk	-round and bulging shape located in the middle of the thick albumen	-Round and Bulging shape.	-Flattened, Blood and meat spots are present
3.2Egg white	-The thick white is firm and round.	-The thick white is reasonably firm.	-Egg white are weak and watery, enlarged and flattened

On the base of quality edible eggs are divided in to three grades. Grading aids orderly marketing by reducing. waste, confusion and uncertainty with respect to quality values. Once graders acquire a working knowledge of the standard of an egg quality, accuracy in interpreting quality standards and ability to correct grade classification will increase.