

Laboratory work № 11

Determination of the quality indicators of eggs

Structure of an Egg

An egg consists of three main parts: the **egg white (54–60%)**, the **yolk (28–32%)**, and the **shell and shell membranes (11–14%)**.

Eggshell

The eggshell is a **calcified shell**, composed of approximately **90% calcium carbonate**, along with **phosphorus and magnesium phosphate**. The color of the shell depends on the **species and breed of the bird**. In egg-laying breeds, the color of the egg tends to range from yellowish to brownish. The shell contains many **microscopic pores**, which allow for **air exchange** and the release of moisture. However, **microorganisms** can also enter the egg through these pores.

At the bottom part of the egg, there is an **air cell**, where the number of pores is even higher. This air cell forms when the egg cools down after being laid, as moisture evaporates from inside the egg. Over time, the **air cell grows**, and this growth is considered one of the **indicators of egg freshness**.

Egg White

The **egg white** is the main **edible part** of the egg. It consists of **four layers**:

1. Outer thin layer (liquid)
2. Thick layer (firm)
3. Inner thin layer (liquid)
4. Chalaziferous layer (boundary layer)

The **chalaziferous (boundary) layer** keeps the **yolk centered** for a certain period. As the egg is stored over time, the **thick albumen** (firm layer) begins to **break down**, and the boundary layer **weakens**, causing the **yolk to slowly mix** with the egg white and move closer to the shell—this process is known as **egg deterioration**. This is another key indicator of egg **freshness and quality**.

The **pH of fresh egg white** is typically **7.2–7.6**, but during storage, it can rise up to **8.2**, which creates a favorable environment for the growth of **putrefactive (spoiling) microorganisms**.

Egg Yolk

The **egg yolk** is a **dense, paste-like** substance enclosed in a **shiny membrane** and has a **spherical shape**. Its color ranges from **pale yellow to dark yellow**, depending on the amount of **carotenoids** present in the yolk, which are derived from the hen's **diet**.

The yolk consists of **light and dark layers**, with the **center filled** with pale yellow paste. The **embryonic disc** is located within the yolk. In **fertilized eggs**, this disc appears as a **3–5 mm pale disc**, whereas in **unfertilized eggs**, it is **smaller**.

The **pH of fresh egg yolk** is **slightly acidic**, typically ranging from **4.8 to 5.2**.

Egg Classification by Freshness

Eggs are classified into **two types** based on **storage duration**:

1. **Dietary eggs (Parhez tuxum)** – Eggs that have been stored for **up to 7 days** after grading.
2. **Table eggs (Oshxona tuxumi)** – Eggs that have been stored for **up to 25 days** after grading.

When stored in **refrigerators** at temperatures between **-1°C and -20°C**, eggs can remain good for **up to 120 days**.

Egg grading (classification) typically begins **one day after the egg is laid**.

Egg Classification by Weight

Both dietary and table eggs are divided into **three categories** based on **weight**:

- **Selected** – 65 grams
- **First category** – 55 grams
- **Second category** – 45 grams

State Standard Requirements

According to **state standards**, dietary and table eggs intended for sale must meet the following conditions:

- The **shell** must be **clean and intact**
- Eggs must be **free from blood stains, feces, or any external contamination**

Dietary and Table Egg Shell Standards

- **Dietary eggs** are allowed to have **only one small spot or streak** on the shell.
- **Table eggs** may have a spot covering **up to 1/8 of the shell surface**.

Egg Labeling and Markings

During the **grading process**, eggs are stamped as follows:

- **Dietary eggs**: Red stamp with codes like **1; 2; 00; 11**
- **Table eggs**: Blue stamp with codes like **1; 2; 00**

These numbers represent:

- **0** – Selected grade
- **1** – First grade
- **2** – Second grade

Veterinary and Sanitary Examination of Eggs

Every batch of eggs brought in for **sale, processing, or storage** must undergo **veterinary-sanitary examination**.

- Each batch must include a **passport or veterinary certificate** confirming **quality and freedom from disease**.
- Without such documents, eggs must be **boiled at 100°C for 13 minutes** before use.

During inspection, the following are evaluated:

- **Cleanliness**
- **Shell color**
- **Shell integrity**

Using a **candling device (ovoscope)**, experts determine:

- **Size of the air cell**
- **Condition of the egg white and yolk**

Weight Standards

- **Chicken eggs weighing less than 45 grams are not allowed for sale**, even if they appear clean and of good quality.

Common Defects in Non-Standard Eggs

Eggs that **do not meet the standard requirements** may exhibit the following defects:

1. **Mixed contents** – Slight mixing of white and yolk
2. **Small spots** – Multiple small, immobile spots inside, occupying up to **1/8 of the egg interior**
3. **Dried and stuck yolk** – Yolk has adhered to the shell and dried out but shows **no mold**
 - o These eggs may still be used in **public catering** or **sent for processing**

Eggs Not Suitable for Human Consumption

Some eggs are considered **unfit for food use** due to the following severe defects:

1. **Tumak** – The interior is **dark and non-transparent**
2. **Krasyuk** – The **white and yolk are completely mixed together**

Defective Eggs and Their Disposal

- **"Bloody ring"** – Eggs with **blood vessels** of various shapes on the **surface of the yolk or egg white**.
- **"Large spot"** – Eggs containing **several large, immobile spots** inside.
- **"Palog'da" eggs** – **Unfertilized eggs** that have been removed from **incubators**.

● Eggs with these types of **defects** are subject to **technical disposal (utilization)** and **must not be used for food**.

Use of Eggs During Infectious Disease Outbreaks on Farms

Depending on the type of disease present in poultry, eggs are handled as follows:

Complete Disposal (Not Used at All):

- If **botulism** is detected in the flock, **eggs must be destroyed** and not used under any circumstances.

Boiling and On-Farm Use Only:

- For **acute and rapidly spreading diseases** such as:
 - o Pasteurellosis
 - o Leukosis

- o Marek's disease
- o Leptospirosis
- o And others
 - Eggs must be **boiled and used only within the farm.**

Processing and Industrial Use (e.g., Confectionery):

- For diseases like:
 - o Tuberculosis
 - o Pseudotuberculosis
 - o Salmonellosis
 - o Colibacteriosis
 - o Streptococcal and staphylococcal infections
 - Eggs can be **sent for processing** and used in **confectionery production.**

Disinfection Before Sale:

- In cases of **fowlpox** and **ornithosis**, eggs must be:
 - o Soaked for **30–12 minutes** in a **lime solution containing 3% active chlorine**
 - o Then **released for sale**

Safe for Sale Without Special Treatment:

- In cases of:
 - o **Mycoplasmosis**
 - o **Infectious laryngotracheitis**
 - Eggs are allowed to be **freely sold without restrictions**

Egg Boiling Requirement

- Whenever boiling is required, eggs must be **boiled for 13 minutes** to ensure safety.

Duck and Goose Eggs

- ****Duck and goose eggs are not allowed for direct sale to consumers.**
- They are **only permitted for use in bread and confectionery production.**

Purpose of the Study:

The aim of this work was to **determine the freshness of chicken eggs** using **organoleptic methods** and **inspection with an ovoscope**.

During the examination, the **shell** of the chicken egg, which surrounds and protects the interior, is first visually inspected.

Chicken eggs prepared for **sale from egg preparation facilities or refrigeration units** are classified into the following types:

Types of Chicken Eggs for Sale:

1. **Dietary (Parhez) Egg**
These include **eggs laid within the last 5 days**.
2. **Fresh Egg**
Eggs stored under **specific conditions of temperature and humidity in warehouses or refrigerators for up to 30 days** fall into this category.
 - o **Storage temperature in refrigerators** should range from **-2 to -2.5°C**, or **+0.5 to +1.5°C**,
 - o Proper **ventilation** must be maintained during storage to preserve quality.
3. **Frozen Egg**
If poultry eggs are stored in **refrigerators for more than 30 days**, they are considered **frozen eggs**.
4. **Lime-Preserved Egg (Oxakli Tuxum)**
If eggs are preserved in a **solution made from slaked lime**, they are referred to as **lime-preserved eggs**.

Required Reagents and Equipment:

- **Ovoscope**
- **Scales (weighing device)**
- **Dietary (parhez/dietik) egg**
- **Fresh egg**
- **Frozen egg**
- **Lime-preserved egg**
- **"Krasyuk" egg** (egg with fully mixed yolk and white)
- **Egg with small internal spots**

Procedure:

Using the **ovoscope**, it's possible to detect:

- **Cracks** that are invisible to the naked eye
- The **size (height)** of the air cell

- The **condition of the egg white and yolk**, and more

After examination, the eggs are **classified based on quality** into:

1. **Edible eggs (for food use)**
2. **Technical rejection (non-edible/defective) eggs**

Edible (High-Quality) Eggs:

These include:

- **Fresh, high-quality eggs**
- **Shells are intact**
- **Air cell is no more than 13 mm in height**
- **Egg white is dense and transmits light uniformly during candling**

During ovoscopic inspection, many eggs may show **light spots** with a "**marble-like appearance**". These spots can be:

- As small as a **pinhead**
- Or **larger**

Non-Edible (Defective) Eggs:

Eggs that are **unsuitable for food use** include those with various **defects**, such as:

- **Cracked and leaking shells**
- **Small internal blood or meat spots**
- **Enlarged air cells**, indicating age or spoilage

