

UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM Timisoara Multidisciplinary Conference on Sustainable Development *15 – 16 May 2025*



Evaluation of egg albumen foaming capacity by an automated method

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Abstract: The optimal conditions for egg albumen foaming were settled using an automated device for foam testing. The method is based on stirring albumen sample in a transparent column at 6000 rpm for 240 seconds and obtaining the appropriate volume of foam. The method was applied for testing the storage time effect (0-28 days) on albumen foaming properties for shell eggs. At 14 days of storage the foaming capacity registered a positive correlation with albumen weight, and negative correlations with albumen height and Haugh units.

Introduction

We proposed an automated method for albumen foaming by using device DFA 100 (Kruss)

The automated method was used to evaluate foaming capacity for storage shell eggs

Material and method



The automated method for determination of albumen foaming capacity using DFA 100 (Kruss) device

Principle of measuring: liquid sample is placed in a transparent measuring column which is located between a linear LED panel and a line sensor. The foaming action is produced by a stainless stirrer located in the base of the column. The line sensor measures the light transmitted through the measuring column over its full height.

to 4 varied times and 3 speed values on foaming)

V is the volume of foam after stirring,

 $FC = (V / Vi) \times 100 (\%)$

 $FS = (Vt/V) \times 100$ (%)

Vi is the volume of initial liquid albumen used for foam

Results and discussions

| Results for parameters | |
|-------------------------------|--|
| of the albumen foaming method | |

Maximum foam capacity (%) obtained at stirring 240 seconds at 6000 rpm – as presented in the table.

| | Speed time (seconds) | | | | | | | | |
|---------------------|----------------------|--------|--------|--------|--|--|--|--|--|
| | 180 s | 210 s | 240 s | 300 s | | | | | |
| Stirrer Speed value | | | | | | | | | |
| F200 | 222.33 | 220.67 | 241.67 | 239.00 | | | | | |
| 5200 rpm | ±7.54 | ±6.60 | ±6.60 | ±7.07 | | | | | |
| | | | | | | | | | |
| 6000 rpm | 214.33 | 225.67 | 250.33 | 250.67 | | | | | |
| | ±6.60 | ±7.07 | ±7.54 | ±8.01 | | | | | |
| | | | | | | | | | |
| 7000 rpm | 237.67 | 241.67 | 236.67 | 239.33 | | | | | |
| | ±7.55 | ±8.02 | ±8.49 | ±7.54 | | | | | |

Results for storage time that influenced the albumen foaming properties. A total of 180 eggs from layer hens were allocated for albumen samples testing (15 eggs for each test, accordingly

Foaming capacity (FC) showed a gradually decreasing as the time storage was increasing. Calculation of albumen foaming capacity (FC) and foam stability (FS) decreased. Foam capacity (%) -253,94 % 250,83 % Vt is the volume of foam measured over time (30 min.) after 248,17 % 28 days 0 days 14 days

Foam stability (FS) was relative constant for a period of 14 days of storage time, after that it



Step 1 (selecting the stirrer and the data recording in frames per seconds or minutes for foaming and decay)





where:

preparation,

foam preparation.

Characterization of storage shell eggs

-eggs were collected from a hen-flock at hen age of 64 weeks (diet contained 180 g/kg crude protein and 2850 kcal/kg metabolizable energy per kg)

-periods for egg testing: 0 days (initial time), 14 days of storage and 28 days of storage

-eggs were evaluated for qualitative physical parameters: egg freshness (albumen height, yolk diameter and Haugh unit, measured using a Digital Egg Tester DET-6500 (NABEL Co., Ltd., Kyoto, Japan), albumen pH, shape index, weight of whole egg and its components

-eggs were evaluated also for foaming capacity using the automated method, and for foam stability over 30 min.

-evaluation if there are any possible correlation between foaming properties and some of the albumen physical parameters

Correlations between albumen physical parameters and foaming properties

• At 0 days of storage, only the FS had appreciative correlations with albumen height (0.764) and HU (0.749). • At 14 days the FC registered a positive correlation with albumen weight (0.735), and negative correlations with albumen height (-0.788) and HU (-0.692).

• For 28 days storage time there were weak correlations between foaming properties and indicators for egg freshness as just to be mentioned HU correlation of 0.490 with FC, and 0.408 with FS.

| | Parameters | | | | | | | | |
|----------------------|---------------|-------------------|-------------------|--------------------|------------------|-------------------|--|--|--|
| Storage time | Albumen pH | Albumen weight | Albumen height | Haugh units, HU | Foam capacity | Foam stability | | | |
| 0 days storage time | | | | | | | | | |
| Albumen pH | 1 | | | | | | | | |
| Albumen weight | -0.463 | 1 | | | | | | | |
| Albumen height | 0.288 | -0.101 | 1 | | | | | | |
| Haugh units, HU | 0.240 | -0.113 | 0.996** | 1 | | | | | |
| Foam capacity | 0.520 | -0.294 | 0.215 | 0.184 | 1 | | | | |
| Foam stability | 0.524 | -0.467 | 0.764 | 0.749 | -0.097 | 1 | | | |
| 14 days storage time | | | | | | | | | |
| Albumen pH | 1 | | | | | | | | |
| Albumen weight | -0.063 | 1 | | | | | | | |
| Albumen height | 0.266 | -0.164 | 1 | | | | | | |
| Haugh units | -0.111 | -0.485 | 0.832 | 1 | | | | | |
| Foam capacity | 0.255 | 0.735 | -0.788 | -0.692 | 1 | | | | |
| Foam stability | -0.156 | -0.498 | 0.075 | 0.453 | -0.539 | 1 | | | |
| 28 days storage time | | | | | | | | | |
| AlbumenpH | 1 | | | | | | | | |
| Albumenweight | 0.871* | 1 | | | | | | | |
| Albumenheight | -0.669 | -0.792 | 1 | | | | | | |
| Haugh units | -0.624 | -0.767 | 0.997** | 1 | | | | | |
| Foam capacity | 0.203 | -0.273 | 0.448 | 0.490 | 1 | | | | |
| Foam stability | -0.113 | -0.456 | 0.366 | 0.408 | 0.601 | 1 | | | |

Conclusions

- The automated method for albumen foaming capacity was established and is easy to use and permit also the foam stability measuring.
- For stored shell eggs the albumen FC showed a gradually decreasing until 28 days of storage. The albumen FS was relatively constant for 14 days of storage, but was decreasing as the storage time is increasing.
- At 0 days of eggs storage, only the FS had appreciative correlations with albumen height and HU. At 14 days of storage the FC registered a positive correlation with albumen weight, and negative correlations with albumen height and HU. For 28 days storage time there were weak correlations between foaming properties and HU as indicator for egg freshness.



