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KEEPING QUALITY OF FAYOUMI EGGS AS AFFECTED BY CLEANING AND STORING CONDITIONS

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SUMMARY

This experimental work was carried out at the Fac. of Agric. Cairo Univ. during 1960, 1961. Internal egg quality measures were secured for groups of Fayoumi eggs stored up to four months periods under different temperatures and humidities. Some groups were compared with naturally clean or cleaned eggs. Sanitary and pasteurization devices were also evaluated. Results are as follows:

1. Eggs stored at room temperature deteriorated more rapidly than those at 50-55°F or 35°F. Raising the humidity level from 50% to 60%, or turning of eggs at room storage helped slightly in maintaining egg quality.
2. Clean eggs kept best while wet-cleaned eggs were the poorest at 50-55°F storage. Soiled and dry-cleaned eggs were intermediate.
3. Thermostabilization treatments after washing with detergent solution seemed to be more useful in keping egg quality up to 4 months of storage at 50-55°F. than using detergent washing followed by sanitary dipping in Borax solution. Soiled untreated eggs were inedible after two months of storage.
4. It is recommended that a comparative system for egg marketing should be initiated to avoid the prevailing drawbacks in egg handling, especially at the farmer's level and during that weather. Egg collection and egg preservation under such scheme are expected to improve egg production in both quantity and quality

INTRODUCTION

Numerous recommendations have been proposed for handling eggs with the hope that subsequent spoilage might be reduced or prevented. These practices include cold storage (Wagenen et al, 1949 ; Stadelman and Wilson, 1957 ; and Wittling et al, 1951), surface cleaning, either with or without water (Baker, 1961 ; Dawson et al, 1950 ; and Lorenz et al, 1952) ; washing with water containing detergent (Miller, 1954, 1956 ; and Baker, 1961) ; washing and oiling (Canner et al 1953, Hollinger, 1953 ; Lorenz and Starr, 1952 and Sauter et al, 1961) ; and heat treatments (Funk, 1944, Funk et al, 1954 ; and Salton et al, 1951).

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The present methods used in egg handling in Egypt are unfortunately far inadequate compared to those practised in American and European markets. There is no actual grading system apart from just visualizing egg size with no attention paid to egg quality. Particularly in summer time, most of the eggs reach consumers in very poor quality. The present investigation was carried out to evaluate some handling methods for Fayoumi eggs during hot weather.

MATERIALS AND METHODS

The experimental work was carried out at the Poultry Research Center, Faculty of Agriculture, Cairo University during 1960 & 1961. Two experiments, A and B, were conducted in each year as indicated in the following procedure :

1960A : A total of 600 eggs were indivdually wieghed then divided at random into three lots to be stored for two months, May and June, as follows :

(*a*) The first lot : at room temperatures where the averages were 85°F with around 40% relative humidity.

(*b*) The second lot : at 50-55°F and 80% relative humidity.

(*c*) The third lot : at 35°F and 80% relative humidity.

A fresh sample of 50 eggs at start, as well as subsequent samples of 50 eggs each, from each lot were measured for qualities after 15, 30, 45, days in storage. The measurements considered here were albumin height, percent of thick albumin, pH of thick albumin, pH of outer thin albumin, yolk index and percent loss in egg wieght.

1960B : During each of the months of July, August and September four groups of 48 eggs each, were stored for four weeks at room temperatures averaging 85°F under the following four categries :

G_1 : Clean eggs at 50% relative humidity.

G_2 : Dirty eggs at 50% relative humidity.

G_3 : Clean eggs at 60% relative humidity.

G_4 : Clean eggs at 50% relative humidity and turned three times daily.

A representative fresh sample of 48 eggs was initially tested for albumin height and yolk index ; while one dozen eggs from each stored group was subsequently tested, at weekly intervals, for these two measurements and percent loss in egg weight.

1961A : Out of 456 clean eggs, 60 eggs were kept clean while the rest were artificially soiled by dipping each egg in a soft mixture of chicken manure, soil bitter and fine nest material. After allowing dirt to dry overnigat, the dirty eggs were devided into three equal groups. One group was then wet cleaned, using a commercial egg washer, while anotner was dry-cleaned, using sand paper and cloth. The third group was left dirty. All groups were then stored at 50-55°F and 80% relative humidity for two months, July and August.

After 30 and 60 days in storage equal samples of the stored groups were tested for quality as measured by albumin height, percent outer thin albumin, yolk index and percent loss in egg weight.

1961 B: In these trials washing devices were compared applying a detergent (typol, a Shell by-product, at the level of 2 table spoons per each five litres of water); a sanitizer (Borax solution at 3%) and thermostabilization. Eggs used were artificially soiled before treatments of equal groups were practised as follows:

(*a*) Dirty eggs washed in typol solution.

(*b*) As in a, then eggs were thermostabilized for 3 minutes at 145°F.

(*c*) As in a, then thermostabilized at 150°F for one minute.

(*d*) As in a, then eggs were dipped for one minute in the borax solution.

(*e*) Control soiled eggs, untreated.

All groups were stored for 4 months, July till October, at 50-55°F and 80% relative humidity. At 30-day intervals egg quality was tested in one-dozen-egg sample per group. Trails investigated were albumin height, percent outer thin albumin, yolk index and percent loss in egg weight.

RESULTS AND DISCUSSION

(1) 1960 *Experiments* :

(Table 1) shows the results obtained in 1960 A experiment. Egg quality dteriorated at room temperature storage to a much greater extent and within a quicker period of time than in cold storage. Storing at 35°F seemed to be slightly more useful than at 50-55°F. Differences between treatments as well as between periods of storage were found to be highly significant (Table 2). The above findings substantiate those reported by Funk (1944), Gibbons (1950). Jeffery and Darago (1940), proudfoot (1962), Wilhelm and Heiman (1938) and Waik et al (1952).

TABLE 1.—**Average for albumin height, percent, and pH ; yolk index ; and percent loss in eggs weight, at room,** 50-55°F **and** 30-35°F **temperature ; and for different periods of storage,** (1960).

Storing conditions	Days in Storage	EGG QUALITIES					
		Albumin Height (cm)	Thick albumin (%)	pH of outer thin albumin	pH of thick albumin	Yolk index	Loss in egg weight (%)
	Fresh	0.740	71.94	8.24	8.24	8.11	0.50	—
Room conditions							
(85°F & 40% R.H.	15	0.402	57.73	8	8.72	8.69	0.16	8.14
	30	0.218	29.41		8.66	8.67	0.16	8.27
	45	0.190	14.10		8.65	8.57	0.12	12.95
	60	0.144	15.87		8.55	8.51	0.11	19.13
50-55°F and 80% R.H.	15	0.564	68.32		8.67	8.64	0.38	2.54
	30	0.308	55.13		8.69	8.69	0.28	2.57
	45	0.264	50.96		8.70	8.70	0.23	4.49
	60	0.272	49.88		8.68	8.66	0.23	5.83
30-35°F and 80% R.H.	15	0.688	71.02		8.67	8.62	0.42	1.62
	30	0.302	71.02		8.64	8.59	0.31	1.76
	45	0.396	57.48		8.67	8.65	0.31	2.97
	60	0.322	52.12		8.63	8.62	0.31	5.35

TABLE 2.—**Levels of significance as obtained by analysis of variance for differences, due to egg treatments and storage periods, in egg qualities studied during the four experiments.**

Experiments	Egg Qualities	State of significance	
		Egg Treatments	Storage period
1960 A.	Albumen Height	**	**
	Percent thick Albumen	**	**
	Albumen pH	**	**
	Yolk index	**	**
	Percent loss in egg weight	**	**
1960 B.	Albumen Height	**	**
	Yolk index	**	**
	Percent loss in egg weight	**	**
1961 A.	Albumen Height	N.S.	**
	Percent outer thin albumen	**	N.S.
	Yolk index	*	N.S.
	Percent loss in egg weight	N.S.	**
1961 B.	Albumen Height	**	**
	Yolk index	N.S.	N.S.
	Percent loss in egg weight	**	**

** significant at 0.01 percent level
* significant at 0.05 percent level
N.S. not significant

The decrease in albumin height was attributed by Romanoff and Romanoff (1949) to the loss of water, not only by evaporation through the egg shell, but also by diffusion to the yolk. The deterioration in the dense albumin was related mainly to physical changes in ovomucin, present in the form of fibers emmenshing the liquid albumin materials. The rapid break down of albumin at high temperatures is largely due to accelerated loss of carbon dioxide through the shell pores. This speeding loss of CO_2 and liquidation of albumin leads to a large transfer of water to the yolk, which eventually becomes enlarged and flattened. Egg-weight-loss during storage is mainly related to the evaporation of moisture and escape of CO_2 and other gases, most of which are the products of the chemical break down of the egg's organic constituents. Such loss in egg weight is hastened by high air temperature and low relative humidity.

The results ontained in experiment B are shown in Table 3. The three egg groups showed a noticeable reduction in egg quality after only one week of storage. This loss continued, although at different rates, throughout the test. The soiled eggs showed the severest decrease in egg quality while the clean eggs held at relatively high level of relative humidity (60%) suffered the least. Turning of eggs at room temperature storage seemed to help somewhat in maintaining egg quality. Differences due to treatments and testing periods were found significant. The above results agree with those given by Dawson and Hall (1954), Funk (1944), Stadelman and Jensen (1951), Stadelman *et al* (1951), Starr *et al* (1952) and Wagenen *et al* (1949).

(2) 1961 *Experiments;*

Table 4 shows the averages for albumin height, percent outer thin albumin, yolk index and percent loss in weight for clean, soiled, dry-cleaned and wet-cleaned eggs after 30 and 60 days in cold storage (50-55°F and 80% relative humidity). Deterioration was least in clean eggs and highest in the wet-cleaned. Differences between clean, dry-cleaned and soiled eggs were however of little magnitude. Statistical analysis proved no significant differences between groups in albumin height and percent loss-in-egg-weight measurements; nor between periods of tests in percent outer thin albumin and yolk index, (Table 2). The fact that naturally clean eggs kept best in storage was early encountered by Civer *et al* (1953), Davidson *et al* (1950) and Lorenz and Starr (1952). Dry-cleaning was preferred to wet-cleaning by Baker (1961) and by Lorenz *et al* (1952). Improper wet cleaning may result in moisture loss, CO_2 escape and bacterial invasion. Wittling *et al* (1951) recommended proper wet cleaning to save time with less breakage.

The results obtained on washing and thermo-stabilization treatments (1961B) are given in Table 5. Heat treatment helped in maintaining albumin and yolk quality in stored eggs. Heating for one minute at 150°F seemed to be of slightly better benifit than heating for 3 minutes at 145°F. Sanitizing in Borax solution after Typol washing was also benificial. The controled soiling of eggs did not result in much deterioration until after 60 days of storage, but those eggs were completely degenerated thereafter, mainly due to bacterial and mold contamination.

TABLE 3.—**Albumen Height, yolk index and percent loss in weight in eggs stored under different conditions* (1960 B)**

Traits	Period of storage (wks)	EGG GROUPS				
		Fresh	G_1	G_2	G_3	G_4
Albumen Height	1	0.487	0.280	0.277	0.340	0.320
	2		0.247	0.233	0.273	0.273
	3		0.200	0.176	0.287	0.237
	4		0.190	0.170	0.210	0.210
Yok index	1	0.41	0.25	0.22	0.30	0.27
	2		0.20	0.18	0.22	0.21
	3		0.12	0.11	0.20	0.18
	4		0.11	0.11	0.18	0.17
Percent loss in weight	1	—	2.82	2.67	1.97	2.32
	2		4.90	5.53	4.53	4.76
	3		7.98	8.35	6.25	6.89
	4		8.78	10.49	8.14	8.69

*G_1 : Clean eggs stored at room temperature.

G_2 : Dirty eggs stored at room temperature.

G_3 : Clean eggs stored in more humid surroundings.

G_4 : Clean eggs stored in turning cabinet.

TABLE 4.—**Average for albumen height, percent of outer thin albumin, yolk index and percent loss in egg weight for clean, solid dry-cleaned and wet-cleaned eggs stored for 60 days at 50-55° F and 80% relative humidity, (1961 A).***

Egg Qualities	Storage period (days)	GROUPS OF EGGS			
		Clean	Soiled	Dry-cleaned	Wet-cleaned
Albumen Height (cm)	30	0.33	0.30	0.29	0.30
	60	0.28	0.26	0.26	0.20
Percent outer thin albumen	30	38.9	40.4	40.8	45.9
	60	39.5	40.9	41.4	48.7
Yolk index	30	0.26	0.25	0.20	0.14
	60	0.25	0.24	0.16	0.14
Percent loss in egg weight	30	2.69	3.24	2.62	2.28
	60	3.58	4.08	3.64	3.86

* Averages for fresh samples were 0.46 c.c., 31.24% and 0.40 for albumen height, percent outer thin albumen and yolk index measurements respectively.

The beneficial effects of pasteurization on stored eggs was first praised by Funk (1943, a and b), and later encouraged by Bose and Stewart (1948), Funk *et al* (1954), Godwin *et al* (1962), Miller (1954) and Salton *et al* (1951). Meanwhile, Baker (1961), Homler and Stadelman (1961) and Miller (1956) recommended using a detergent in the washing water to prevent the invasion of harmful organisms. For best results Wittling *et al* (1951) advised using a combination of detergent-germicide cleaning solutions. The advantage of the mostabilization in this connection is suggested to be due to the coagulation of a thin film of outer albumin which will not only helps in reducing contamination but also will assist in reducing escape of CO_2 and moisture.

TABLE 5.—**Effect of washing, thermostabilization of eggs, and period of storage on, albumen height, percentage of outer thin albumen, yolk index, and percentage loss in weight, when storing at 50-55°F and 80 percent relative humidity, (1961 B).**

Treatments	Storage period in days	Albumen height (cm)	Percent of outer thin albumen	Yolk index	Percent loss in weight
Washing with Typol ..	30	0.24	38.58	0.24	3.70
	60	0.23	41.17	0.21	3.71
	90	0.23	40.73	0.18	3.86
	120	0.23	45.88	0.19	4.03
Washing with Typol, then Thermostabilization in 145° F for 3 minutes..	30	0.26	30.68	0.31	3.52
	60	0.26	35.08	0.28	3.61
	90	0.23	34.24	0.24	3.70
	120	0.22	36.11	0.22	3.87
Washing with Typol, then Thermostabilization in 150° F for one minute	30	0.33	35.56	0.29	2.17
	60	0.26	36.67	0.26	3.26
	90	0.25	37.93	0.25	3.27
	120	0.25	42.76	0.23	3.75
Washing with Typol, then dipped in Borax solution	30	0.26	32.46	0.26	3.13
	60	0.25	38.54	0.29	3.42
	90	0.24	40.41	0.27	3.53
	120	0.26	44.57	0.21	3.57
Control soiled eggs	Fresh	0.46	31.24	0.40	—
	30	0.30	40.37	0.25	3.24
	60	0.26	40.55	0.24	4.08
	90*	—	—	—	4.31
	120*	—	—	—	7.10

* The control soiled eggs were completely deteriorated internally at 90 and 120 days of storage period.

PRACTICAL APPLICATION

The facts presented here on keeping quality of eggs under the different treatments are believed to be of practical significance. Within only one week, eggs stored at room temperature were found to deteriorate sharply; and the elementary methods of raising humidity level or egg turning at storage proved to be of slight benefit in avoiding quality loss. Cold storage seems to be a necessity for preserving egg euqlity and more attention should be given to obtaining naturally clean eggs. If cleaning has to be done, detergent and stabilizing solutions are recommended over merely dry-cleaning or washing with just plain water. Thermostabilization was the most effective method studied.

However, most of our market eggs come from village-channels, where farmers have no facilities for proper egg handling. To improve egg quality, a co-operative way in marketing eggs is very much needed. Farmers need to pay greater attention for producing clean eggs than is commonly observed. They might be encouraged to use typel cleaning, if deemed necessary, with only one piasture additional cost to clean 1000 eggs. Through cooperative agreements, eggs sould be collected twice weekly from nearly villages to be handled and stored in some central cold-storing units for further distribution. It is also suggested that eggs would be purchased on a simplified grading system for size and quality. Milk pricing on percent-fat-content test has proven successful. A part from the initial cash price received at delivery, successful egg producers would also be entitled to an extra bonus for high quality eggs. Egypt used to export a good quantity of shell-eggs to European markets, a trade which stopped mainly because of inferior quality of shipped eggs. With the need of commodity exchange and the more pressing demand for foreign currency, it might be of help to resume this abroad market with an improved egg product.

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تأثير عملية التنظيف والتخزين
على قدرة البيض الفيومى على الحفظ

الملخص

أجريت هذه التجارب فى سنوات ١٩٦٠ ، ١٩٦١ فى مزرعة دواجن قسم تربية الحيوان بكلية الزراعة جامعة القاهرة • وقد تبين ان البيض الذى اجرى تخزينه فى درجة الحرارة العادية قد تدهورت صفاته بسرعة أكثر من البيض الذى خزن تحت درجات حرارة قدرها ٥٠ ــ ٥٥ ف أو ٣٥ ف كما تبين ايضا أن رفع نسبة الرطوبة من ٥٠٪ الى ٦٠٪ أو تقليب البيض فى حالة تخزينه فى درجة حرارة الجو العادية قد ساعد بقدر محدود على احتفاظ البيض بصفاته دون تدهور •

وقد وجد ان البيض النظيف احتفظ بصفاته احسن من البيض المنظف بالغسل تحت درجة حرارة ٥٠ ــ ٥٥ ف اما البيض المتسخ والبيض المنظف على الناشف فكانت مقدرته على الحفظ متوسطة •

هذا وقد ثبت ان الاحتفاظ بدرجة حرارة ثابتة طول الوقت للبيض المغسول بمواد مذيبة للدهون أحسن من استعمال هذه المواد ثم غمس البيض فى محلول البوراكس تحت درجة حرارة ٥٠ ــ ٥٥ ف •

هذا كما اتضح ان البيض الغير معامل لم يمكنه الاحتفاظ بصفاته تحت نفس الظروف أكثر من شهرين فقط بينما احتفظ البيض المعمل بصفاته لمدة ٤ شهور •