قسم: الصحة ومراكبة الأغذية
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التطوع البكتريولوجي ل唂شر البيض

أحمد عبد الحميد، مصطفى خليل، فوزي أبوالخير، توفيق البسيوني

لما كان للبيض من أهمية كبيرة من حيث قيمته الغذائية، فهو أيضا يعتبر مصدرًا مهمًا للبكتيريا المرضية مما يشكل خطورة على صحة الإنسان، لذلك قمنا بجمع عدد 125 بيضة يمثلون 25 مجموعة عشوائية من أسواق مدينة أسوان ومحال البيع المختلفة وقمنا بالتعرف على مدى تلوث قشر البيض من الخارج بالبكتيريا المختلفة.

ولقد تبين أن متوسط العدد الكلي للبكتيريا الموجود على سطح البيض كان 37 × ¹₀⁻¹ بينما متوسط العدد الكلي لـ Coliforms, Faecal coliform, Enterococci and S. aureus كان كما يلي 3 × ¹₀⁻³ إلى 1 × ¹₀⁻⁶ لكل قشرة على التوالي.

وذلك تم عزل وتصنيف عدد 17 ميكروب وهي:

S. aureus, Staph. epidermidis, Micrococcus, Enterococci, E. coli, Enterobacter, Citrobacter, K. tsaii, Arizona, Acinetobacter, Pseudomonas and Serratia.

ولقد ناقش البحث علاقة هذه الميكروبات بتلوث محتويات البيض من الداخل وكذلك منتجاته أثناء التصنيع ومدى خطرته على صحة الإنسان، وكذلك الطرق الواجب اتباعها لمنع تلوث البيض بهذه البكتيريا.
BACTERIAL CONTAMINATION OF EGG SHELLS
(With 2 Tables)

By
A.A-H. AHMED; M.K. MOUSTAFA; F. ABOUL-KHIER
and T.A. EL-BASSIONY
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SUMMARY

125 of commercial hen’s eggs were collected at random from Assiut markets and different groceries. The egg samples were examined superficially for bacterial contamination which may be present on shells. The mean value of total bacterial count, Coliform, faecal coliform, Enterococci and S. aureus counts were, $37 \times 10^5$, $3 \times 10^5$, $6 \times 10^5$, $16 \times 10^2$ and $\_100$/shell, respectively. Different isolates (117) were identified as, S. aureus, Staph. epidermidis, Micrococcus, Strept. faecalis, strept. faecium, Intermediate, Ecoli, Enterobacter, Citrobacter, Klebsiella ozansae, Arizona hinshawai, Acinetobacter calcoaceticus, Pseudomonas aurogenosa and Serratia.

INTRODUCTION

Microbiology of eggs and egg shells has received inadequate attention so far, from the view points of public health and economic. Bacteria on egg shells have been implicated as a source of contamination of broken out eggs (SOLOWY et al. 1946 and KRAFT et al. 1967). Moreover, bacteria on shells may also, under certain conditions, penetrate through the shells into the interior and cause spoilage (BOARD, 1968).

Levels of bacterial contamination ranging from $10^2 - 10^8$/shell, have been reported by HAINES, 1938; ROSSER, 1942; FORSYTHE et al. 1953 and BOARD et al. 1964. Reports recorded by HAINES, 1938; ZAGAEVKSY and LUTIKOVA, 1944 and BOARD et al. 1964, showed that Coliform, Enterococci, Staphylococci, Micrococcus, Flavobacterium, Pseudomonas and other aerobic gram-negative rods, could be isolated from shells of commercial hen’s eggs. On the other hand, BOARD et al. (1964) detected one strain of salmonella from shell of a slightly soiled egg. In a study described by MOATS (1979), the level of bacterial contamination/shell ranged from $2.1 \times 10^1 - 5.11 \times 10^5$, while Coliforms, Staphylococci and Enterococci counts were $2.50 - 2.05 \times 10^5$, $500 - 49.5 \times 10^4$ and $250 - 22 \times 10^3$/shell, respectively. Prevalence of salmonella organisms on eggs as reported by BAKER and GOFF (1980) was 0.21% of examined egg shells. MOATS (1980) found that, log 10 of 4.26 - log 10 of 6.46 organisms/shell was the level of bacterial contamination of examined egg shells. Also, he added that, Coliform, Strept. faecalis, Micrococcus and Staphylococci were 10, 8, 5 and 41% of the isolates recovered from egg shell, while 3% of the isolates were found to be S. aureus.

Our investigation was undertaken with the object of ascertaining the level of microbial contamination as well as, the different microorganisms which may found on shell.
MATERIAL and METHODS

Collection of samples:
125 eggs (25 groups) were collected, at random, from Assiut markets and different groceries. Every 5 eggs (one group) were placed in a sterile plastic bag and dispatched to the laboratory.

Preparation of samples
Eggs were tested by a surface rinse method, where each egg was immersed in 100 ml. of Tryptic soy broth in a jar and shaken for 15 min. on a mechanical rotatory shaker. The rinse solution obtained from the five eggs of each group were combined and subjected to the following examination:

1- Total bacterial count
Serial dilutions of rinse solution were prepared using 0.1% sterile peptone water. Standard plate count was determined with duplicate plates of standard plate agar as described in Standard Methods (A.P.H.A. 1978).

2- Coliform count
Duplicate plates of Violet red bile agar were used for each dilution as described in Standard Methods (A.P.H.A., 1978).

3- Faecal coliform by sing Violet red bile agar at 44°C (KLEIN and FUNG, 1976).


5- Isolation and enumeration of S. aureus:
Numbers of S. aureus were determined by using Baird-parker agar plates (BAIRD - PARKER, 1962). Duplicate plates were prepared and incubated 48 h. at 37°C. Furthermore, appropriate amount of rinse solution of each sample was inoculated into a tube of Sod. chloride broth, which was then incubated at 37°C. for 24 h. (BAILEY and SCOTT, 1978). A loopful from the incubated tubes was streaked onto a plate of mannitol salt agar (BAILEY and SCOTT, 1978). Confirmation of colonies suspected to be S. aureus was accomplished by the DNase test of LACHICA et al. (1971).

6- Isolation and identification of other Staphylococci and Micrococcus were the same as described by BAILEY and SCOTT, (1978).

7- Isolation and identification of Enterobacteriaceae were performed by using API 20E strips (anly-tab products, Plainview, N.Y., U.S.A.).

8- Isolation of salmonella was carried out according to the method recommended by SPECK (1976), then the isolates were identified by API 20E strips.

RESULTS

All results obtained from the examined samples are recorded in Tables 1 & 2.

DISCUSSION

The results presented in Table 1, show the max., min., and mean values of total bacterial count, Coliform, faecal coliform, Enterococci and S. aureus count. A lower count of total bacteria was found by HAINES (1938); ROSSER (1942); FORSYTHE et al. (1953) and MOATS (1979), while BOARD et al. (1964) recorded a max. of 107 bact./shell. Lower percentage of samples containing...
BACTERIAL CONTAMINATION OF EGG SHELLS

Coliforms were stated by BOARD et al. (1964), while higher counts of Coliform ranged from 50 - 205 x 10^2 shell have been detected by MOATS (1979). Higher level and incidence of Enterococci were obtained by MOATS (1979) and BOARD et al. (1964). In other instances, a lower incidence of Enterococci was recorded by ZAGAEVSKY and LUTIKOVA (1944) and MOATS (1980). Evidence of contamination with faecal matter was indicated by isolation of faecal coliform. Also, our results reveal a higher incidence of S. aureus (60%) than that reported by MOATS (1980), but a higher level of S. aureus/shell was detected by MOATS (1979).

The results summarized in Table 2, show the different types of isolates recovered from egg shells. The incidence of Staphylococcus and Micrococcus on egg shells was higher than that obtained by ZAGAEVSKY and LUTIKOVA (1944) and BOARD et al. (1964). As far as can be ascertained, the widely distribution of Staphylococcus in nature and on skin of warm blooded animal (BAIRD - PARKER, 1963) can prove the high incidence of such organism. E.coli and Enterobacter were recovered from egg shells in higher incidence than that recorded by BOARD et al. (1964) and MOATS (1980). Pseudomonas was isolated, but in a lower percentage than that of HAINES (1938). It has been proposed that Pseudomonas, Coliforms and E.coli were among the main types causing spoilage of intact egg (SCOTT et al. 1950-1951 and FLORIAN and TRUSSEL, 1957). Salmonella could not be detected in our examined samples, however PAKER and GOFF (1980) isolated salmonella (0.21%) from the examined egg shells. Two isolates presumed to be Sigella, but could not be assured due to lack of antisera. Different isolates were recovered from the examined egg shells, including Citrobacter, Arizona hinshawi, Klebsiella ozaenae, Acinetobacter and Serratia.

It is pertinent to note that bad storage of eggs under a very humid condition, could support the multiplication of microorganisms present on egg shells (HAINES, 1983 and FORSYTHE et al. 1953). Furthermore, these bacteria may contaminate the content of egg either by penetration or withdrawal through the shell pores, following cooling of freshly laid contaminated egg (MCLAURY and MORAN, 1959). It has been documented that members of these bacteria have been implicated in cases of enteritis, epidemic or summer diarrhoea in infants, urinary infection, food poisoning and intestinal disorders (SMITH and CONANT 1960 and FRAZIER, 1967). Also, many of such bacteria have been implicated in spoilage of eggs, leading to economic losses. Moreover, the contamination of egg shells may be responsible for lowering the microbiological quality of egg products by the use of broken-out or cracked eggs.

This study can be used to deduce the most probable sources of contamination to which eggs are exposed, including dust, soil faecal matter, as well as, bad handling. In conclusion, hygienic measures and educational program should be imposed in poultry farms and on egg producers.

REFERENCES


### BACTERIAL CONTAMINATION OF EGG SHELLS

**Table (1):** Count of some microorganisms recovered from egg shells

<table>
<thead>
<tr>
<th>Types</th>
<th>Positive samples</th>
<th>Min./shell</th>
<th>Max./shell</th>
<th>Mean/shell</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No./25</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total bact. count</td>
<td>25</td>
<td>100</td>
<td>(6 \times 10^5)</td>
<td>(81 \times 10^7)</td>
</tr>
<tr>
<td>Coliform count</td>
<td>16</td>
<td>64</td>
<td>*/ 100</td>
<td>24 (\times 10^3)</td>
</tr>
<tr>
<td>Faecal coliform count</td>
<td>6</td>
<td>24</td>
<td>*/ 100</td>
<td>8 (\times 10^3)</td>
</tr>
<tr>
<td>Enterococci count</td>
<td>16</td>
<td>64</td>
<td>*/ 100</td>
<td>19 (\times 10^3)</td>
</tr>
<tr>
<td>S. aureus</td>
<td>20</td>
<td>80</td>
<td>*/ 100</td>
<td>*/ 100</td>
</tr>
</tbody>
</table>

* No colonies could be detected on the plates.

**Table (2):** Incidence and frequency distribution of different isolates recovered from egg shells

<table>
<thead>
<tr>
<th>Isolates</th>
<th>No. of positive samples</th>
<th>Isolates</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No./25</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steph. aureus</td>
<td>20</td>
<td>80</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Steph. epidermidis</td>
<td>10</td>
<td>40</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Micrococcus</td>
<td>14</td>
<td>56</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Strept. faecalis</td>
<td>15</td>
<td>60</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Strept. faecium</td>
<td>5</td>
<td>20</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Intermediate</td>
<td>3</td>
<td>12</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>E.coli</td>
<td>12</td>
<td>48</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Enterobacter : aerogenes</td>
<td>1</td>
<td>4</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>- agglomerans</td>
<td>3</td>
<td>12</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>- cloacae</td>
<td>3</td>
<td>12</td>
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<td>3</td>
</tr>
<tr>
<td>- hafniae</td>
<td>8</td>
<td>32</td>
<td></td>
<td>8</td>
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<td>Citrobacter:</td>
<td></td>
<td></td>
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<tr>
<td>- freundii</td>
<td>4</td>
<td>16</td>
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<td>4</td>
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<tr>
<td>- diversus</td>
<td>1</td>
<td>4</td>
<td></td>
<td>1</td>
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<tr>
<td>Klebsiella ozaenae</td>
<td>8</td>
<td>32</td>
<td></td>
<td>8</td>
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<tr>
<td>Arizona hinshawii</td>
<td>1</td>
<td>4</td>
<td></td>
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<tr>
<td>Serratia :</td>
<td></td>
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<tr>
<td>- liquefaciens</td>
<td>3</td>
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<td>- rubidaea</td>
<td>2</td>
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<td>1</td>
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<tr>
<td>Acinetobacter calcoaceticus</td>
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<td>4</td>
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<td>1</td>
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<tr>
<td>Shigella species</td>
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<td>Pseudomonas aurogenosa</td>
<td>1</td>
<td>4</td>
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117 100
