دراسة مدى تلوث الهواء داخل المفرخات البلدية بالميكروبات المرضية ومدى علاقتها بنسبة التفريخ

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الملخص

تم اختيار ٣٣ عينة هواء مأخوذة من داخل خمس مفرخات بلدية فى محافظة أسيوط بكتريولوجيا أثناء مدة حضانة البيض وذلك لمعرفة مدى تلوث الهواء بالميكروبات المرضية المختلفة ومدى تعرض الكتاكيت للاصابة بالأمراض .

وقد ثبت أن أعلى نسبة لتلوث الهواء داخل المفرخات البلدية بالميكروبات تكون قرب نهاية فقس البيض أو بعد الفقس مباشرة .

كما ثبت أن هناك علاقة واضحة بين مدى تلوث الهواء داخل المفرخات البلدية بالميكروبات ونسبة الفقس فى البيض فقد اتضح أن أعلى نسبة للفقس تكون فى المفرخات النظيفة التى فيها أقل نسبة من الميكروبات المختلفة بينما قلت نسبة الفقس فى المفرخات الملوثة الهواء .

كما اتضح من البحث أن الميكروبات المرضية التى تم عزلها هى الميكروب السبحى القولونى ـ الميكروب العنقودى الذهبى ـ والميكروب العضوى القولونى ـ وميكروب البروتيس ـ وميكروبات الكليبسيلا ، وهى نفس الميكروبات المسببة لمرض التهاب السره فى الكتاكيت .

وقد تبين من البحث مدى القصور فى تطبيق المواصفات الصحية المطلوبة داخل المفرخات البلدية ومدى أهمية تطبيقها لضمان زيادة انتاج الكتاكيت السليمة .

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STUDIES OF THE BACTERIOLOGY OF AIR INSIDE BALADY INCUBATORS AND ITS RELATIONSHIP TO EGG HATCHABILITY

(With 2 Tables and one Figure)

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SUMMARY

A total of 33 air samples from five balady incubators along the egg incubation process were examined bacteriologically. It has been found that high microbial population exist, especially close to or at the completion of hatching.

A significant correlation between air pollution and egg hatchability was found. The hatchability rate in eggs incubated in an environment low in bacterial content was superior to that of highly polluted air. Moreover, the type of organisms isolated were the same as those commonly encountered in cases of omphalitis in baby chicks.

Generally, the sanitation measures adopted in balady incubators are not sufficient and are difinitely responsible for considerable losses.

INTROUDCTION

The extent of bacterial contamination in hatcharies is of particular importance in the poultry industry, owing to the current methods frequently practiced and to the large number of newly hatched chicks usually maintained in close proximity. Moreover, the channelling of eggs from a variety of sources through relatively small numbers of hatcharies and the subsequent wide-redistribution of chicks are conditions favourable for the spread of infections diseases.

VOLKMAR (1929) stated that the increase in bacterial content of air in the incubator at hatching time was the major factor in spreading of omphalitis or navel infection in baby chicks. The average diameter of the pores of incubated eggs varied from 6-13 u (BUXTON and GORDON, 1947) which readily permit microorganisms to penetrate the shell.

ROMANOFF and ROMANOFF (1949) reported that very diversified types of micro-organisms may be present on the egg-shell. The shell pores are usually covered with a bloom which prevents the entrance of surface bacteria to the inside of the egg. On the other hand, if this organic substance is totally or partially removed by abrasion, handling, washing or long storage, the pores are opened and microbial invasion immediately becomes possible.

CHUTE and GERSHAM (1961) found that gross contamination of the egg-shell with faeces is an obvious source of air pollution in hatcheries. Moreover, GENTRY *et al.* (1962) reported that the overall chick mortality during the first two weeks of life was higher in chicks hatched in incubators containing a high bacterial content.

The mechanism of bacterial penetration through shell pores has been studied by WILLIAMS and WHITEMORE (1967).

QUERLES *et al.* (1970) reported that the bacterial content on the shells of eggs are related to their concentration in the air of poultry houses. They concluded that the hatchability of eggs produced in wire floor pens was superior to eggs from litter floor nests. In the same year, SHIMOKYRA *et al.* showed that the most common infections in dead chicks were due to E. coli Klebsiella, Rettgerella and Enterobacter organisms which were transmitted from the incubators atmosphere.

Knowing that a "clean chick" is likely to hatch in a clean incubator, this study was undertaken to provide information about air-borne bacteria in native hatcheries.

MATERIAL AND METHODS

The air of 33 rooms in five balady incubators designated A, B, C, D and E located in El-Quesseia, El-Bessary, Mankabad and Bani-Mohamed (Assiut province) were subjected to bacteriological examination. Samples were collected at different periods beginning from the first week up to hatching of eggs. The floor plan and the working pattern were the same in all investigated incubators.

PROCEDURE

An aspirator bottle of 10 liters capacity was filled with water and connected with a sterile glass tube of 15 cm long having a rounded pulp at its middle and containing 2 gm of sterile glass beads moistened with sterile distilled water via a sterile rubber tubing. On running the test, the water was allowed to run through a side opening allowing the prevailing air to replace the water in the bottle, passing through the moistened glass beads. The finely suspended particles including the air-borne bacteria were mostly captured by the moistened beeds. This process was continued until the whole amount of water has been evacuated, which indicated that 10 liters of air passed through the sterile beeds. The tube was aseptically closed from both sides.

In the laboratory, the beeds were suspended in 50ml of sterile saline solution, and shaked thoroughly for 10 minutes. The following tests were then carried out:

1.—*Total bacterial counts*

Serial dilutions were prepared up to the order of 10^{-7} using sterile saline solution. One ml from each dilution was mixed thoroughly with about 10 ml of standard plate count agar. After solidification, the plates were incubated at 37°C for 24 hours. The average number of colonies per 10 liters of air was calculated and recorded.

2.—*Detection of pathogenic micro- organisms*

Enterobactariaceae spp. were mainly investigated in the following manner: Bottles containing 50 ml of selenite F broth were aseptically inoculated with about 2 ml from the original saline suspension, and incubated at 37°C for 18 hours. Loopfuls from resulting growth in the enrichment medium were streaked on brilliant green agar plates and incubated for 24 hours at 37°C. Suspected colonies were isolated and subjected to further identification according to the procedure of EDWARDS and EWING (1962).

Other pathogens were also investigated in the following manner: A loopful of 24 hours nutrient broth culture, previouly inoculated from the original saline suspension, was streaked on blood agar and salt mannitol agar plates. Colonies appearing after a 24 hours incubation at 37 °C were identified morphologically and biochemically according to CRUICKSHANK *et al.* (1969).

RESULTS AND DISCUSSION

The results recorded in Table 1 reveal that all air samples near or at the completion of hatching, showed high microbial populations. At the first week of incubation in balady incubators A, B, and D, there were 1500, 4950 and 2000 bacteriaper cubic meter of air on average. However, the mean numbers of bacteria in the same incubators reached 5000, 21750 and 4002 per cubic meter during the last week respectively. Yet, air borne bacteria were counted during the second and third weeks in the incubators designated E, and during the last week only in that named C.

The extent of bacterial contamination in such incubators is naturally dependent on many factors. Among these are the raising of dust during turning of eggs, the available ventilation rate and the hygienic standards adopted. During the first week of incubation fuel material usually consisting of straw were burned as the source of heat. The combustion of straw produces gases which may have an adverse effect on bacterial propagation (AHMED, 1975).

TABLE 1 Total colony count per cubic meter of air during egg incubation and its relation to egg hatchability

Balady incubator	No. of air samples examined	First week			Second week			Third week			Average	% of hatchability
		Max	Min	Mean	Max	Min	Mean	Max	Min	Mean		
A.—El-Qusseia . . .	6	2500	500	1500	5000	5000	5000	7000	4000	5000	3833	75.7
B.—Kom-Abbas . .	7	7500	2400	4950	9000	2700	5500	22500	21000	21750	1073ù	61.0
C.—Mankabad . . .	3	—	—	—	—	—	—	120000	4400	8266	8266	64.9
D.—El-Bessary . .	10	5400	240	2000	2400	11000	1733	6000	3000	4200	2644	80.9
E.—Bani-Mohammad	7	—	—	—	4000	4000	7866	12500	5000	8700	8283	62.3
Total . .	33	5133	1046	2816	7600	3200	5024	18000	7480	9583	6751	—

TABLE 2. Percentage distribution of isolates

Incubator	No.of air samples examined	isolates														Total
		Strept. faecalis		n-haem Strept.		Staph. aureus.		E.coli		Gaffkya		Proteus sp.		Klebsiella		
		No.	%	No.		No.		No.	%	No.	%	No.	%	No.	%	
A-El-Qusseia . . .	6	3	50.0	—	0	—	0	2	33.3	1	16.6	1	16.6	1	16.6	8
B-Kom-Abbas .	7	6	85.7	3	42.8	2	28.4	5	71.4	2	28.4	3	50.0	4	56.8	25
C-Mankabad . . .	3	2	66.6	1	33.3	1	33.3	3	100.0	—	0	2	66.6	1	33.3	10
D-El-Bessary . . .	10	4	40.0	1	10.0	—	0	3	30.0	1	10.0	—	0	2	20.0	11
E-Bani-Mohammad	7	5	71.4	4	56.8	1	14.2	6	85.7	1	14.2	2	28.4	—	0	19
Total . .	33	20	60.6	9	27.2	4	12.1	19	57.5	5	15.1	8	24.2	8	24.2	73

Also' the comparative dryness of the atomsphere within such enclosed premises may lead to a reduction in the numbers of air-borne micro-organisms. However, the process of heating was stopped from the 10 th day till the end of the hatching period. Suspended particles including bacteria are relatively heavier than air, and in the absence of air currents tend to settle down on egg shells. Henceforth, eggs inside such incubators may be exposed to additional loads of contamination by micro-organisms. These may penetrate through the shell pores and influence the hatchability rate.

It is worth mentioning that the results achieved in this study revealed a positive significant correlation between bacterial numbers present in the air during incubation and the hatchability rate (Table 1).

The significance of air-borne bacteria as shell contaminants was previously studied by SHUTE and GERSHAM (1961, GENTRY *et al.* (1962) and CHUTE *at al.* (1963), who demonstrated the presence of high levels of air-brone contamination in hatcheries. The mechanism of bacterial penetration through egg pores has been studied by WILLIAMS and WHITEMORE (1967).

It is clear from Figure 1 that the most active period of contamination yielding the peake of counts extended from the 11*th* to the 17*th* day of egg incubation. This may be due to the maximum activity of workers in turning eggs (four times daily), as well as to the improper cleanliness of the place from broken shells, feathers or droppings. However, periods at which the counts remained consistently low usually fall between the first to 10*th* day of incubation. This may be due to closing the openings of the incubators to avoid air currents and to keep the temperature stable.

On the other hand, at the end of the hatching period, bacterial contamination of the air reached its maximum at the 21*th* day due to the dense chick population and the unusual consequent activity of workers. This constitute a very serious hazard to the newly hatched chikes.

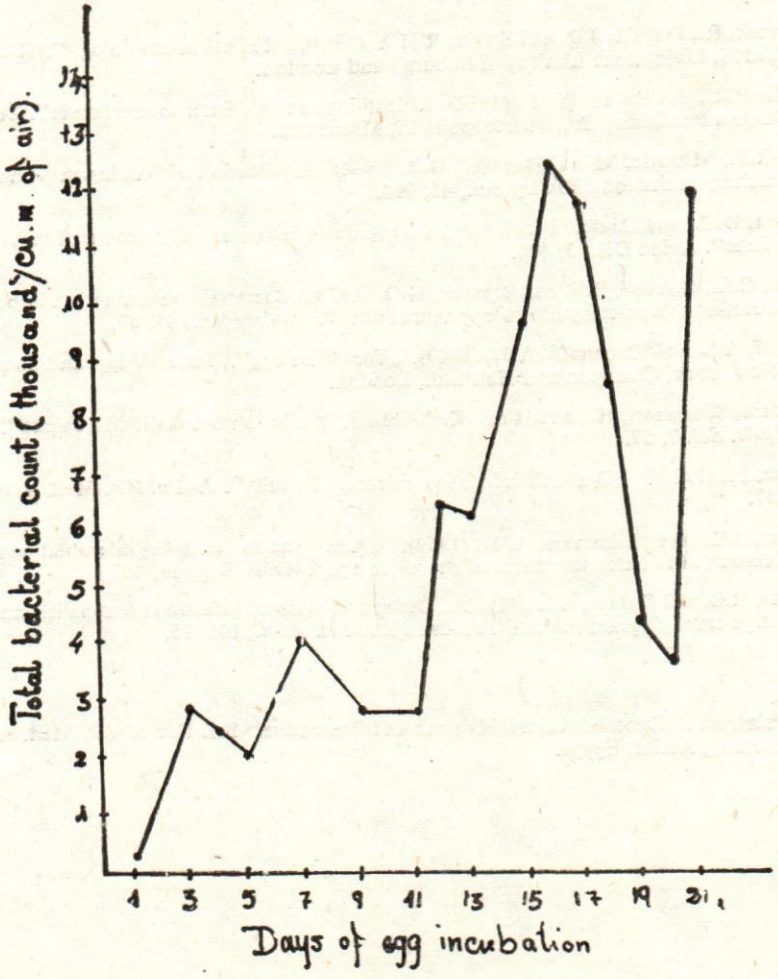
In order to obtain a more realistic evaluation of the severity of microbial population in balady incubators. the potentially pathogenic micro-organisms isolated in the course of this investigation are listed in Table 2. The pathogenicity of these organisms was established by several investigators (VOLKMAR 1929; WILLIAMS and DAINES, 1942; O'MEARA and CHUTE, 1959 and SHUTE and GERSHAM, 1961). They concluded that the increased bacterial content of the air in incubators at hatching time was the major factor in the production of omphalitis in newly hatched chicks. Generally, the type of organisms isolated from air inside balady incubators in the present study were the same as those commonly encountered in omphalitis.

The arbitrary figures proposed by CHUTE and GERSHAM (1961) to be used in the evaluation of hatchery cleanliness indicate that a clean incubator should have a bacterial count of 20 or less per cubic foot. However, from

the data reported in the presence study, it is evident that existent hatchery sanitation is not adequate to control contamination in most balady incubators.

AHMED (1975) found that formaldehyde fumigation of these native hatcheries resulted in an increased rate of hatchability. Therefore, disinfection of eggs, incubators and other equipments concerned with chick raising is highly recommended.

Nowadays, the steadily increasing consumption demand for poultry is generating an excellent market potentiality. This makes the poultry industry as being of high economic importance. Therefore, it is exceedingly important to imporve the hygienic conditions in balady hatcheries in order to avoid transmission of infection, and efforts should be paid to realize this potentiality.



Fgh .1. The Average numbers of bacteria along the period of egg incubation in balady incubators

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