

## HATCHING POWER OF SOME DEVELOPED CHICKEN STRAINS IN RELATION TO MINERALS CONCENTRATION IN EGG SHELL MEMBRANES

### 1- Physical Mobilization of Minerals in Eggshell Membranes

By

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**Abstract:** *The present experiment was undertaken to determine the mineral concentrations (calcium, magnesium, sodium and potassium) of shell membranes of fertile and infertile eggs for Bandarah (B) and Mandarah (M) chicken strains at different times during incubation and their effect on egg weight loss during incubation. Experiments were conducted utilizing total number of 1600 hatching eggs obtained from both chicken strains for detection hatching traits. Besides eighty eggs were used for minerals determination in shell membranes of fertile and infertile eggs.*

**Results obtained are summarized as follows:-**

- 1- Fertile egg weight loss exhibited the significant ( $P \leq 0.05$ ) higher egg weight loss compared to infertile eggs during the incubation intervals of 0-5, 18- pipping and 0-pipping days.
- 2- There was a marked significant ( $P \leq 0.05$ ) increase of calcium concentration in fertile eggs of shell membranes for B and M strains on 18<sup>th</sup> days of incubation and at pipping.
- 3- Calcium concentration in shell membrane for fertile eggs of M strain was significantly ( $P \leq 0.05$ ) increased compared to B strain on 5<sup>th</sup> and 18<sup>th</sup> days of incubation and at pipping.
- 4- Generally, magnesium, sodium and potassium concentrations in fertile egg for both chicken strains were significantly ( $P \leq 0.05$ ) decreased with the increase of incubation age.
- 5- Chicken strain had a significant effect on calcium, potassium and magnesium concentrations in shell membranes of fertile eggs at pipping date while this significant effect was not observed in infertile eggs.

- 6- *Highest percentages of embryonic mortality for B and M strains were recorded during the first five and latest days of incubation and between day 18 to pipping date.*
- 7- *Hatchability of fertile and total eggs percentages were significantly ( $P \leq 0.05$ ) higher for B chicken strain compared with those for M strain.*
- 8- *Minerals concentration change or mobilization in eggshell membranes of fertile eggs could be related to egg weight loss and consequently affect the embryonic mortality and hatchability.*

## **INTRODUCTION**

The shell membrane of an avian egg acts as a bag enclosing albumen and water (Yohizaki and Saito, 2002). Nutrient absorption, metabolism, and deposition in shell membranes vary with hen's genetics (Lillie *et al.*, 1951). Also, wide variation of minerals concentration was found in eggshell membranes between different breeds at the same stage of incubation (Tullett and Burton, 1985). Marginal deficiencies of mineral concentration can significantly affect some flocks but not others, leading to higher embryonic mortality rate at the end of incubation (Wilson, 1997). It is pertinent to consider both the fine structure and chemical composition of the shell membranes as the main source of oxygen permeability in terms of water content (Tranter *et al.*, 1983). Howard (1953) found that mineral concentration changed during embryonic development, consistent with a contribution of the embryonic tissues in generating and/or maintaining the ionic balance of the egg contents. Also, Howard (1957) concluded that sodium (Na) and potassium (K) transport by the epiblast and epithelium of the early chick embryo. Christensen (1990) suggested a vital role for membrane Na and K in determining eggshell water vapor conductance at the plateau stage of incubation. Packard and Packard (1993) found that avian embryos mobilize large quantities of calcium (Ca) from the eggshell (Packard and Packard, 1984; Simkiss, 1991). Embryo inside the egg develops specific mechanisms to mobilize previously stored mineral by means of transport proteins (Vieira, 2007). Tranter *et al.*, (1983) observed that concentration of Na and K in the shell membrane of fertile eggs diminished significantly during the first 3 day of incubation, and that of magnesium (Mg) decreased between days 3 and 9. In contrast, the concentrations of these cations in the membranes of infertile eggs decreased (Na) or increased (K and Mg) slightly during the first 18 day of incubation. Also, Narushin and Romanov, (2002) reported that the success of embryonic development has been related to eggshell and shell membrane characteristics. The permeation of air through the eggshell and shell

membranes affects the hatchability (Tullett and Deeming, 1982; Peebles and Brake, 1987). Rizk *et al.*, (2008) indicated that the shell membranes had an important role and could affect embryonic mortality and hatchability. The current study was undertaken to determine the mineral concentrations (Ca, Mg, Na and K) of shell membranes of fertile and infertile eggs for Bandarah and Mandarah strains at different dates during incubation in relation to egg weight loss during incubation and embryonic mortality.

## MATERIALS AND METHODS

This study was conducted at EL-Sabahia Poultry Research Station (Alexandria), Animal Production Research Institute, Agricultural Research Center, Egypt. Chickens from Bandarah (B) and Mandarah (M) chicken strains were randomly housed in individual cages in open-sided house under the same environmental condition. Chickens were divided into two groups. The first hens group was artificially inseminated for getting the hatching fertile eggs, and second one for producing the infertile eggs. Experimental diet was formulated according to Feed Composition Tables (2001).

A total of 1600 hatching eggs from both strains were used for detection hatching traits, besides eighty eggs were used for minerals determination in shell membranes of fertile and infertile eggs. Eggs were incubated in forced draft-type incubator (Egyptian made) at 99.5°F temperature and 55% relative humidity in the setter and 98.6°F temperature and 65% relative humidity in hatcher unit. All eggs were individually weighed before setting in the incubator as zero time and then they were weighed again on, 5th, 18th and at first time of pipping to obtain egg weight loss percentages.

Egg weight loss percentage was calculated for each egg within a certain incubation interval as a percentage of the initial egg weight as follow:

$$\text{Egg weight loss\%} = \left( 1 - \frac{\text{Weight of egg on a certain day of incubation period}}{\text{Initial egg weight}} \times 100 \right)$$

Egg that failed to hatch at the end of incubation and having full opportunity were broken out and then examined macroscopically to estimate the embryonic development and assigned according to their time of death during the intervals (0-5), (5-18), (18–pipping), (0–18), and (0–pipping) days. Fertility was calculated as the percentage of fertile eggs from total setting eggs. Hatchability was calculated as the percentage of sound chicks that hatched from either total or fertile eggs.

Mineral concentrations (Ca, Mg, Na and K) of fertile and infertile eggs were detected on zero, 5<sup>th</sup>, 18th days and at the first signs of pipping for both chicken strains egg. Twenty eggs were randomly selected from both fertile and infertile eggs for each mentioned incubation date. The inner eggshell membrane and part of the outer shell membrane, which may have adhered to the inner membrane, were removed from the eggs and then washed three times in deionized water, and dried as described by Tranter *et al.* (1983). The dried membranes were weighed to the nearest 0.01mg and wet-ashed in 8 ml of 1N hydrochloric acid plus 12 ml of methanol for 4 days at room temperature. An aliquot of the resulting mineral solution was placed in a 0.5 lanthanum chloride solution in deionized water. The aliquot was diluted appropriately to determine Ca, Mg, Na and K concentration using atomic-absorption spectrophotometry (Solar, AA series, Thermo Elemental). The relative mineral concentration of each eggshell membrane was computed by dividing the observed concentration of each mineral by the dried membrane weight (milligrams of mineral per gram of dried membrane weight).

Statistical analysis of data was subjected to the ANOVA using SAS software (SAS, 1990). Means were compared using Duncan's multiple range test (Duncan, 1955).

## RESULTS AND DISCUSSION

Egg weight loss percentages for fertile and infertile eggs in B and M chicken strains at various incubation intervals are shown in Table 1. Initial egg weight did not vary for both egg types. From inspection of this table, fertile egg weight loss exhibited the significant ( $P \leq 0.05$ ) greater egg weight loss compared to infertile eggs during the incubation intervals of 0-5, 18-pipping and 0-pipping days. Also, the incubation interval between 5-18 days did not exhibit any significant difference of egg weight loss percentage between fertile and infertile egg types. Regardless of egg type either in fertile and infertile eggs there were no significant differences in overall means of egg weight loss among the incubation intervals between M and B strains. Accordingly, egg weight loss for fertile eggs during the whole incubation period (0-pipping day) was 12.72% and it significantly increased compared with those for infertile eggs (9.23%). The increase of egg weight loss for hatched eggs during the first five days of incubation support the results reported by Christensen and McCorkle (1982) who mentioned that turkey egg weight loss has been characterized as highest during the first seven days of incubation. Also, Tullett and Deeming (1982) observed on increase in egg permeability around the early days of incubation and they attributed this to drying of the inner shell membranes. Beside, results herein

which reveal the lowest egg weight loss during the middle period of incubation (5-18 days) compared with relatively higher losses at the beginning and end of incubation support the results of Brake et al., (1993) and Vick et al., (1993) in chicken.

Moreover during the period of (18-pipping days) the greater egg weight loss was exhibited by fertile egg type compared to infertile eggs due to the embryonic development during the final phase of development and increasing the embryonic respiration (water production) as the embryo approached and passed plateau metabolism. Supporting to this notion, Kutchai and Steen (1971) found that water content in the shell membranes of fertilized chicken egg decreases from 70% to about 40% in 17th day of incubation, whereas the membranes of unfertilized eggs lose very little of their water content. At late stage of development, the drying of embryos is necessary for the embryos to initiate air breathing and adapt to live on land and to open the cloacal membrane (Baintner and Feher, 1974). The eggshell and shell membranes may regulate evaporation of water from eggs as 10% to 11% of the water was lost through these envelopes in domestic fowl eggs during the incubation period (Tullett and Deeming, 1987). It is concluded from this table that fertile eggs lose a greater percentage of weight as water vapor or gases due to embryonic activity and development compared with those in infertile egg.

Table 2 demonstrates Ca concentration in shell membrane of fertile and infertile eggs at different dates of incubation for B and M strains. Generally, Ca concentrations in shell membranes of fertile eggs for both experimented strains were significantly ( $P \leq 0.05$ ) increased especially on 18th and pipping days of incubation compared to that at zero and 5th days. Also, there was a marked increase of Ca concentration in fertile eggs for both strains on 18th day of incubation and at pipping. It is clear from data of this table that there was a numerical increase of Ca concentration during the first five days of incubation for fertile and infertile eggs in B and M strains. The increase of Ca concentration in fertile eggs for B strain was from 2.53 mg/g at zero day of incubation to 15.53 mg/gm on pipping day. Also, in M strain at the same mentioned dates the increase of concentration was 2.60 mg/g and 16.80 mg/g, respectively. Calcium concentrations in shell membrane for fertile eggs of M strain were significantly ( $P \leq 0.05$ ) increased compared to those in B strain on days 5 and 18 of incubation and at pipping. Whereas there were no significant differences between chicken strains with respect to Ca concentrations in infertile eggs. Moreover, Ca concentrations in shell membranes for fertile eggs in both strains were significantly

( $P \leq 0.05$ ) increased compared to those for infertile eggs at zero, 5th, 18th and pipping days.

The increase in of Ca concentration in the shell membrane of fertile eggs on days 18 and at pipping are in accordance with those reported by Board and Love (1980) who mentioned that the increase on day 21 probably reflects the carry over of tips of the cones from the inner surface of the shell. Also, different authors reported that about 80% of the calcium in a chick is obtained from the eggshell at a late stage of development. This fact leads to think that water must move smoothly into the spaces between the shell membranes and the eggshell for mobilization of Ca from the eggshell and water is indispensable in the mobilization of Ca from the eggshell (Ono and Wakasugi, 1984; Yoshizaki and Saito, 2002). Moreover, Richards (1991) mentioned that calcium concentration in shell membrane increased during incubation.

Table 3 shows Mg concentrations in shell membrane of fertile and infertile eggs at different dates of incubation for B and M strains. Generally, Mg concentration in fertile eggs for both strains was significantly ( $P \leq 0.05$ ) decreased with the increase of incubation age. Whereas this trend of decrease was realized in infertile eggs without significant differences except on pipping date for B strain and on 18th and pipping dates for M strain. Also, chicken strain had a significant influence on Mg concentrations during all dates of incubation (zero, 5, 18 and pipping) in fertile and infertile eggs as well except on pipping date in infertile eggs. Besides, the significant differences in Mg concentrations between fertile and infertile eggs were evident on 18th day and on pipping date of incubation for B strain.

As can be seen from Table 4, the statistical significant decrease of Na concentration in shell membranes of fertile eggs had the same trend for both chicken strains by the advancing age of incubation except between days 5 and 18 of incubation. This trend of decrease was previously recorded for Mg concentration which had decreased with the embryonic age. Besides, Na concentration in infertile eggs had no special trend either for increase or decrease with the incubation age for B and M chicken eggs. Data of the research point regarding Na concentration in infertile eggs and through incubation dates could be explained in the light of the fact that eggs have not embryos to play a role in the change of Na concentration with the advance of incubation age. The change in the mineral concentration of infertile eggs could be due to the evaporation or egg weight loss as being affected by temperature and humidity surrounding the eggs in the incubator. In addition, neither chicken strain nor egg fertilization had a continuous significant effect on Na concentration at different incubation dates.

Data of K concentration in shell membranes of fertile eggs in Table 5 demonstrate significant decrease of concentration from zero time of hatching till the time of pipping in B and M chicken eggs. Whereas, in M strain there was no significant difference between K concentrations at 18 days. Opposite trend of results was observed for K concentration in infertile eggs for B and M eggs as K concentrations for both strains significantly ( $P \leq 0.05$ ) increased with the advanced dates of incubation periods from zero to pipping. The trend of K concentration change in infertile eggs differs than that for Na concentration through incubation periods. Moreover, significant differences were detected for B strain between fertile and infertile eggs on zero time, 18th day and pipping date and for M strain at zero time and pipping date.

Generally, the concentrations of Na and K in the shell membranes of fertile eggs for B and M strains were significantly ( $P \leq 0.05$ ) diminished during the first five days of incubation, yet for Mg mineral, this significant decrease was detected for M strain only but not for B strain. Whereas, Table 2 reveals that Ca concentration significantly ( $P \leq 0.05$ ) increased during this early period of incubation. It means that Ca cation has a different trend of change than Mg, Na and K cations during the first five days of incubation. Also, there was no significant strain difference with respect to Na concentration during the period between 5th and 18th days of incubation. Furthermore, Na concentration significantly decreased for both chicken strains during the last three days of hatch. The same trend of the significant decrease for both chicken strains was observed for Mg and K during the last days of hatch except for K mineral in fertile eggs of M strain. The data of this research are in harmony with those reported by Tranter et al., (1983) who mentioned that concentrations of Na and K in the shell membranes of fertile egg diminished significantly during the first 3 days of incubation and Mg concentration decreased between days 3 and 9. Moreover, Christensen (1990) reported that Mg, Na and K concentrations of eggshell membranes of fertile eggs declined during incubation. Also, the same author reported that reductions in Na concentration to near undetectable levels were also observed at day 20 and 24 of turkey incubation. This suggests a vital role for membrane Na or K in determining eggshell water vapor conductance at the plateau stage of incubation and supports previous observations of Na-K dependent active transport system (Hoyt, 1979; Davis et al., (1988). Beside, Tranter et al., (1983) suggested that mineral flux to and from turkey eggshell membranes was very similar to that of chicken eggshell membranes and the concentration of individual minerals may also be related to the eggshell water vapor conductance .Water vapor conductance is

though to be regulated by the osmotic or evaporation loss of water from the keratin fibers constituting the inner shell membrane (Robel., et al., 1986; Davis et al., 1988; Seymour and Piiper, 1988).

In addition, Christensen (1990) mentioned that if active transport of mineral exists in the inner membrane or if an electrical gradient exists across the membrane, the ratios of Na to K or Ca to Mg may be physiologically important to maintain osmotic balance.

As can be seen from data of K and Mg minerals at pipping date, there was statistical difference between the concentrations of these minerals in eggshell membranes of fertile and infertile eggs for each chicken strain. Moreover, chicken strain had a significant effect on the K and Mg concentration in fertile eggs at pipping date, while this significant effect was not observed in infertile eggs. This observation was true in Ca and not in Na concentrations.

Taken together, these results may indicate that the mobilization and changes of detectable minerals in egg shell membranes are associated with embryonic growth in fertile eggs and not in infertile eggs. Mineral concentration change in eggshell membrane could be related to egg weight loss.

Table 6 shows the fertility and hatchability of fertile and total eggs percentages for both B and M chicken strains. There were no significant differences between B and M strains with respect to fertility percentages. While, hatchability of fertile and total eggs percentages were significantly ( $P \leq 0.05$ ) higher for B chicken strain compared to M chicken. Different authors came to the same conclusion herein that there were significant differences between local breeds with respect to hatchability of fertile and total eggs (Abdel Galil, 2004 and Ensaf et al., 2005).

Figure 1 illustrates percentage of embryonic mortality during different incubation periods for B and M strains. Highest percentages of embryonic mortality for B and M strains were recorded during the first five days and latest days of incubation between 18th and pipping days. This result further supports the positive influence of egg weight loss during these intervals on embryonic. Also, there was no embryonic mortality during the period between 10 to 18 days of incubation. Mandarah strain recorded higher percentage of mortality (6.89% and 5.51%) compared to B strain (3.42% and 2.73%) during the periods (0-5d) and (18–pipping days) of incubation, respectively.

Embryonic mortality percentages are of great economic importance for the poultry industry because they are components of hatchability. Differences in embryonic mortality between strains could be explained in the light of genetic differences as reported by Hutt, (1969) and Jassim et al., (1996). Moreover, the results of distribution of embryonic mortality in two peaks over the first and last phases of incubation are in accordance with those obtained by Romanoff, (1949) and Landauer (1951) who reported that peaks of mortality are known to occur at two periods of incubation, namely in the first week and from the fifteenth day onwards. The second phase coincides with the period when the demand for oxygen increases significantly (Rol'nik, 1970). The outcome of this research regarding the results of egg weight loss during early and late periods of incubation and increasing embryonic mortality during these intervals confirms the notion of Peebles and Marks (1991) who suggested the differences in rate of water loss may be casually related to embryonic mortality. Such a hypothesis would explain why embryonic deaths occur late in the incubation period in experiments creating a nutritional Mg deficiency in hens (Sell et al., 1967). Christensen (1990) reported that the possibility exists that excessive Mg at the level of the inner membrane may interact with water, the fibrous proteins of the membrane, or the narrow band of electron-dense material to increase their resistance to gas flow. Plasma Ca and Mg were elevated in hatchling from eggs with high rates of water loss .The inability to regulate plasma Ca may be negative consequence of excessive water loss and could contribute to increase mortality of embryos (Packard and Packard., 1993). In conclusion, information obtained from this experiment indicates that minerals in shell membranes have a possible role in regulating functional eggshell properties. Also, the change of these mineral concentrations in shell membranes due to any factors affecting egg weight loss during incubation and consequently affect embryonic mortality and hatchability.

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**Table 1: Egg weight loss percentages (X±SE) during various incubation intervals of fertile and infertile eggs for Bandarah (B) and Mandarah (M) chicken strains**

Egg type	Initial egg weight(g)		Days of incubation														
	B	M	0-5d			5-18d			18-pipping			0-18d			0-pipping		
Fertile	52.28	50.10	3.02	3.61	3.37 <sup>a</sup>	6.65	7.13	6.93	2.78	3.05	2.94 <sup>a</sup>	9.46	10.53	10.09	11.96	13.25	12.72 <sup>a</sup>
	±	±	±	±	=	±	±	±	±	±	±	±	±	±	±	±	±
	1.74	0.82	0.39	0.50	0.33	1.36	1.23	0.88	0.47	0.31	0.26	1.47	0.96	0.81	1.68	1.06	0.91
Infertile	52.33	50.25	1.93	1.48	1.67 <sup>b</sup>	6.55	6.31	6.41	1.37	1.34	1.35 <sup>b</sup>	8.35	7.70	8.98	9.61	8.94	9.23 <sup>b</sup>
	±	±	±	±	=	±	±	±	±	±	±	±	±	±	±	±	±
	0.80	0.36	0.70	0.32	0.34	0.71	0.44	0.38	0.43	0.91	0.53	1.12	0.42	0.52	1.16	0.91	0.69
Overall means	52.30	50.16	2.52	2.66		6.60	6.76		2.13	2.29		8.95	9.27		10.87	11.34	
	±	±	±	±		±	±		±	±		±	±		±	±	
	0.96	0.50	0.40	0.40		0.77	0.70		0.37	0.47		0.92	0.65		1.06	0.86	

a and b means within a column with no common superscripts differ significantly (p ≤ 0.05)

**Table 2:** Calcium concentration (mg/g) shell membranes of fertile and infertile eggs at different incubation dates for Bandarah (B) and Mandarah (M) chicken strains

Egg type	Chicken strain	Days of incubation			
		Zero	5	18	pipping
Fertile	B	2.53±0.16 <sup>c X</sup>	2.77±0.131 <sup>c Y</sup>	7.47±1.23 <sup>b Y</sup>	15.53±1.91 <sup>a Y</sup>
	M	2.6±0.073 <sup>c X</sup>	3.20±0.073 <sup>c X</sup>	9.96±0.16 <sup>b X</sup>	16.80±0.219 <sup>a X</sup>
Infertile	B	1.70±0.02 <sup>Y</sup>	1.91±0.027 <sup>Z</sup>	2.31±0.082 <sup>Z</sup>	3.60±0.109 <sup>Z</sup>
	M	1.85±0.028 <sup>Y</sup>	1.95±0.259 <sup>Z</sup>	2.55±0.028 <sup>Z</sup>	3.90±0.173 <sup>Z</sup>

X, Y and Z Means within a column with no common letters differ significantly (P≤ 0.05)

a, b and c Means within a row with no common letters differ significantly (P≤0.05)

**Table 3:** Magnesium concentration (mg/g) shell membranes of fertile and infertile eggs at different incubation dates for Bandarah (B) and Mandarah (M) chicken strains.

Egg type	Chicken strain	Days of incubation			
		Zero	5	18	pipping
Fertile	B	0.36±0.03 <sup>a Y</sup>	0.35±0.012 <sup>a Y</sup>	0.29±0.016 <sup>b Z</sup>	0.25±0.017 <sup>c Y</sup>
	M	1.02±0.004 <sup>a X</sup>	0.71±0.047 <sup>b X</sup>	0.43±0.013 <sup>c XY</sup>	0.17±0.077 <sup>d Z</sup>
Infertile	B	0.40±0.12 <sup>a Y</sup>	0.43±0.06 <sup>a Y</sup>	0.42±0.022 <sup>a Y</sup>	0.39±0.026 <sup>b X</sup>
	M	0.88±0.040 <sup>a X</sup>	0.78±0.109 <sup>a X</sup>	0.48±0.017 <sup>b X</sup>	0.44±0.002 <sup>b X</sup>

X, Y and Z Means within a column with no common letters differ significantly (P≤ 0.05)

a, b and c Means within a row with no common letters differ significantly (P≤0.05)

**Table 4:** Sodium concentration (mg/g) shell membranes of fertile and infertile eggs at different incubation dates for Bandarah (B) and Mandarah (M) chicken strains

Egg type	Chicken strain	Days of incubation			
		Zero	5	18	pipping
Fertile	B	0.61±0.013 <sup>a X</sup>	0.47±0.012 <sup>b X</sup>	0.46±0.058 <sup>b</sup>	0.41±0.130 <sup>c Y</sup>
	M	0.63±0.03 <sup>a X</sup>	0.36±0.032 <sup>bc Y</sup>	0.39±0.035 <sup>b</sup>	0.37±0.110 <sup>c Y</sup>
Infertile	B	0.64±0.005 <sup>a X</sup>	0.46±0.017 <sup>c X</sup>	0.54±0.132 <sup>b</sup>	0.41±0.182 <sup>d Y</sup>
	M	0.46±0.01 <sup>c Y</sup>	0.46±0.017 <sup>c X</sup>	0.53±0.019 <sup>b</sup>	0.72±0.012 <sup>a X</sup>

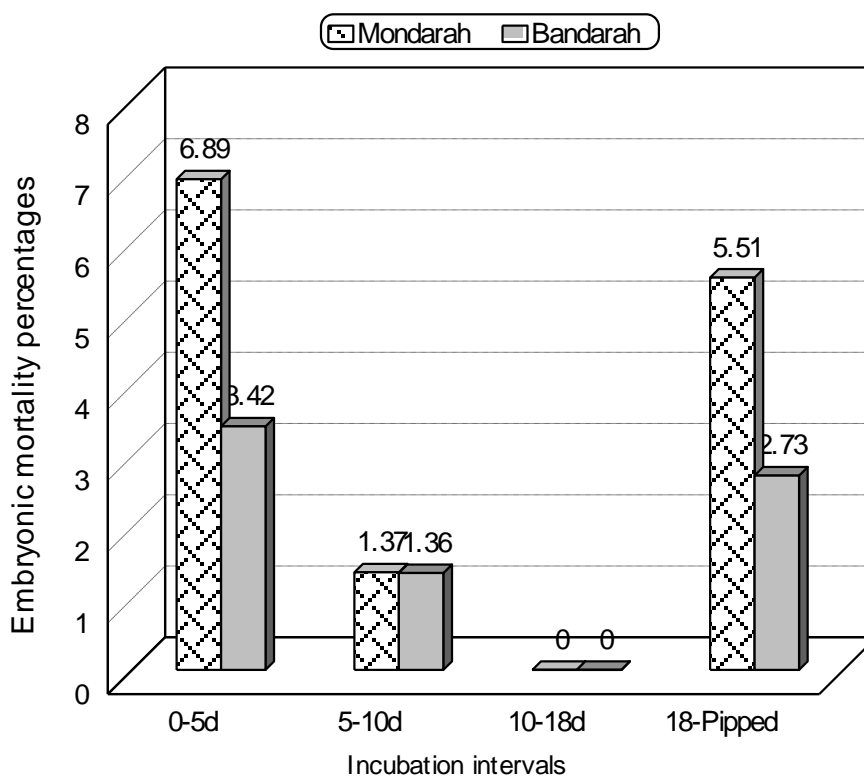
X and Y Means within a column with no common letters differ significantly (P≤ 0.05)

a, b and c Means within a row with no common letters differ significantly (P≤ 0.05)

**Table 5:** Potassium concentration (mg/g) shell membranes of fertile and infertile eggs at different incubation dates for Bandarah(B) and Mandarah(M) chicken strains.

Egg type	Chicken strain	Days of incubation			
		Zero	5	18	pipping
Fertile	B	0.57±0.01a X	0.48±0.009b XY	0.17±0.007c Z	0.10±0.004d Z
	M	0.50±0.042a XY	0.45±0.06b XY	0.37±0.119c YZ	0.36±0.224c Y
Infertile	B	0.41±0.004d YZ	0.55±0.002c X	0.74±0.007b X	1.02±0.007a X
	M	0.33±0.044d Z	0.38±0.07c Y	0.55±0.14b XY	1.11±0.058a X

X, Y and Z means within a column with no common letters differ significantly ( $P \leq 0.05$ )  
 a, b and c means within a row with no common letters differ significantly ( $P \leq 0.05$ )



**Figure (1):** Embryonic mortality percentages during various incubation intervals for Mandarah and Bandarah chicken strains.

**Table 6:** Fertility and hatchability percentages for Bandarrah and Mandarrah chicken strains

Traits Chicken strain	Fertility %	Hatchability of fertile eggs	Hatchability of total eggs
Bandarrah	92.20±1.00	90.88±1.09 <sup>a</sup>	83.77±1.65 <sup>a</sup>
Mandarrah	90.26±0.56	84.57±0.91 <sup>b</sup>	76.34±0.36 <sup>b</sup>

a and b means having different superscript in each column are differ significantly (P≤0.05)

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## الملخص العربي

### قدرة التفريخ لبعض سلالات الدجاج المستنبت وعلاقتها بتركيز المعادن في أغشية قشرة البيض

#### 1- الحركة الطبيعية للمعادن في أغشية قشرة البيض

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أجريت هذه الدراسة لتقدير تركيز بعض العناصر المعدنية (كالسيوم-ماغنسيوم- صوديوم- بوتاسيوم) وذلك في أغشية قشرة البيض المخصب والغير مخصب أثناء الفترات المختلفة للتفريخ وأثر ذلك على الفقد في وزن البيضة أثناء التحضين في تلك الفترات وذلك لسلالتى البندرة والمندرية. وقد أجريت هذه التجربة باستخدام عدد 1600 بيضة مخصبة لدراسة صفات التفريخ بالإضافة إلى استخدام عدد 80 بيضة لتقدير تركيز المعادن في أغشية قشرة البيض في فترات مختلفة لكلا السلالتين.

وتتلخص أهم النتائج المتحصل عليها في الأتى :-

- 1- نسبة الفقد في وزن البيض المخصب كان أكثر معنويا بالمقارنة بنسبة الفقد في وزن البيض الغير مخصب وذلك أثناء فترات التحضين (صفر-5 ايام) و (18 – وعند النقر) وأيضا من (صفر- وعند النقر) وذلك في أغشية قشرة البيض
- 2- كان هناك زيادة معنوية لتركيز عنصر الكالسيوم في أغشية قشرة البيض المخصب لكل من السلالتين عند عمر 18 يوم والنقر.
- 3- تركيز عنصر الكالسيوم في أغشية قشرة البيض المخصب لسلالة المندرية كان أكثر معنويا بالمقارنة بسلالة البندرة وذلك عند اليوم الخامس والثامن عشر وعند النقر
- 4- عموما حدث إنخفاض في تركيزات عنصر الماغنسيوم والصوديوم والبوتاسيوم في أغشية قشرة البيض المخصب لكلا السلالتين وذلك مع زيادة عمر الجنين أثناء التحضين البيض
- 5- تأثرت السلالة معنويا بتركيز عنصر الكالسيوم والبوتاسيوم والماغنسيوم في أغشية قشرة البيض المخصب عند النقر بينما لم تلاحظ هذه المعنوية في البيض الغير مخصب
- 6- أعلى نسبة نفوق جنينى تم تسجيلها في كلا السلالتين وذلك في الخمسة أيام الأولى والأيام الأخيرة من تحضين البيض وذلك في الفترة بين (اليوم 18- وعند النقر)
- 7- نسبة التفريخ من البيض المخصب والبيض الكلى كانت أكثر معنويا في سلالة البندرة وذلك بالمقارنة بسلالة المندرية.
- 8- وجد أن التغير في تركيز العناصر وحركتها في أغشية قشرة البيض المخصب له علاقة بالفقد في وزن البيض وبالتالي النافق الجنينى والتفريخ.