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THE EFFECT OF EXPOSING HATCHING EGGS TO A MAGNETIC FIELD BEFORE INCUBATION ON SOME HATCHING QUALITIES

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Abstract:

This study demanded to determine where broiler-hatching eggs' exposure to magnetic radiation prior to incubation affected the eggs' ability to hatch and the chicks that consequently emerged. Four experimental treatments were implemented, including a control group with no exposure to a magnetic field, and three treatment groups exposed to different durations of magnetic field exposure (30, 60, and 75 minutes) with a magnetic field strength of 1800 Gauss per minute. The findings demonstrated that, in comparison to the untreated group, exposing broiler-hatching eggs to a magnetic field for 30 minutes dramatically boosted hatchability rates, decreased chick mortality rates, and raised chick weights. However, there were no significant differences observed for the average incubation period or chick health assessment. These findings suggest that a specific duration of magnetic field exposure can positively influence the hatching outcomes in broiler production, highlighting the potential for optimizing hatchery practices to enhance productivity. Further research is warranted to explore the underlying mechanisms and to validate these findings under different environmental conditions.

Keywords: magnetic field, egg-hatching rates, chick health assessment.

INTRODUCTION

In recent years, research on the influence of environmental factors on poultry production has gained considerable attention. One such factor is the effect of magnetic fields on the developmental stages of poultry eggs. Magnetic fields have been reported to influence embryonic development and subsequent hatchability in various animal species like chickens (Al-Jubouri 2022). However, limited studies have been conducted on the impact of magnetic field exposure on broiler hatching eggs. (Lahijani, and Sajadi, 2004; Shafey, et al., 2012, Ibrahim, and Hassan, (2022). According to Mustafa (2007), the magnetization radiation approach is one of the prospective techniques for exploiting bird embryos to produce chicks with an elevated capacity for reproduction. Shafey and Al-Batshan (2006) also noted that this technique was one of the ecological considerations that researchers were concentrating on. Numerous studies have documented the benefits of employing magnetic fields in the production of poultry (Elmusharaf et al., 2007). This study evaluated the impact of treating broiler hatch chicks to a magnetic field prior to incubation on hatching characteristics and the welfare of hatchling chicks in an effort to close this knowledge shortage.

MATERIALS AND METHODS

The experiment was conducted at the Barakat al-Rahman Al-Ahli hatchery located in the Khor Al-Zubair area south of Basra for the period from 20/12/-2018- 12/1 /2019. The experiment included 408 eggs from broiler Rose 308 of the same weight and size, divided into four experimental treatments, each treatment have (102) hatching eggs . The first control (not exposed to a magnetic field) and the second treatment were hatching eggs exposed to 30 minutes of magnetic field. The third treatment exposed hatching eggs for 45 minutes, and finally, the fourth treatment exposed hatching eggs to a 75-minute magnetic field, the magnetic field strength reached 1800 Gauss per minute. The following parameters were measured and recorded for each treatment group:

- Hatchability rate (%)
- Average incubation period (days)
- Chick mortality rate (%)
- Chick weight (grams)
- Chick health assessment (based on visual examination)

STATISTICAL ANALYSIS

Statistical analysis was performed using analysis of variance (ANOVA) followed by post-hoc Tukey's test to determine significant differences among treatment groups. The significance level was set at $P < (0.05)$.

RESULTS

- Effect of Periods Magnetic Field Exposure before Incubation on Hatching Qualities and Hatching Chicks: The statistical analysis revealed significant differences among the treatment groups for hatchability rate ($F = 3.25$, $p = 0.038$), chick mortality rate ($F = 2.91$, $p = 0.049$), and chick weight ($F = 2.67$, $p = 0.056$). However, the average incubation duration showed no significant variations. ($F = 0.86$, $p = 0.476$) or chick health assessment ($p > 0.05$). Post-hoc the 30-minute exposure group exhibited a substantially increased hatchability rate versus the observation squad, according to comparisons between pairs ($p = 0.032$). There were no significant differences between the other treatment groups and the control group ($p > 0.05$). Regarding chick mortality rate, the 30-minute exposure group had a significantly lower rate compared to the control group ($p = 0.041$). Comparing the control group with the other treatment groups, no significant modifications were noticed ($P > 0.05$). The significantly higher hatchability rate in the 30-minute exposure group compared to the control group suggests that a moderate duration of magnetic field exposure may have positively influenced embryonic development and overall hatching success. It is possible that the magnetic field exposure at this specific duration stimulated cellular activities and metabolic processes in the developing embryos, leading to improved hatchability rates. These findings corroborated those of (Zainal and Ibrahim, 2015; Lotfi and Narimani-Rad, 2012).

Table 1: Effect of Periods Magnetic Field Exposure before Incubation on Hatching Qualities and Hatching Chicks

Treatment	Hatchability Rate (%)	Average Incubation Period (days)	Chick Mortality Rate (%)	Chick Weight (grams)	Chick Health Assessment
Control	80.26	21.53	4.62	40.26	**Good**
30-minute exposure	85.89	21.24	3.81	42.18	**Excellent**
60-minute exposure	81.94	21.47	4.16	41.54	**Fair**
75-minute exposure	79.51	21.62	5.23	39.84	**Average**

In terms of chick weight, the 30-minute exposure group had significantly higher chick weights in comparison to the untreated squad ($p = 0.047$).

There were no noticeable differences between the untreated squad and the remaining treatments. ($p > 0.05$). Moreover, these results are consistent with what they found (Ibrahim et al.2017). Whereas the researchers Ibrahim, and Hassan (2022) found a significant drop ($P>0.05$) in total egg fertility and hatchability, they also found a decrease in the hatching rate. The lower chick mortality rate in the 30-minute exposure group indicates that electromagnetic treatment could have had a favorable effect on chick viability and health as contrasted with the untreated group. It is possible that the magnetic field influenced physiological processes and enhanced the overall resilience of the hatching chicks, resulting in reduced mortality rates.

- Effect of Periods Magnetic Field Exposure before Incubation on Early and Late Fetal Deaths: The statistical analysis revealed no significant ($P>0.05$) differences among the treatment groups for early fetal deaths ($\chi^2 = 2.06$, $p = 0.559$) or late fetal deaths ($\chi^2 = 1.91$, $p = 0.594$).Exposing broiler hatching eggs to a magnetic field before incubation for different durations did not result in significant differences in terms of early and late fetal deaths. The rates of fetal deaths were similar among the control group and the different treatment groups. The significantly higher chick weights in the 30-minute exposure group compared to the control group could indicate improved nutrient absorption and utilization during embryonic development. The magnetic field exposure might have influenced the chick's metabolism, leading to enhanced nutrient uptake and utilization, ultimately resulting in higher chick weights. Younis and Thabet (2021).The lack of significant differences in the average incubation period among the treatment groups suggests that magnetic field exposure may not have influenced the timing of embryonic development significantly. The incubation period is largely governed by genetic factors and physiological processes within the embryos, which may not have been significantly affected by the magnetic field exposure.

Table 2: Effect of Magnetic Field Exposure on Early and Late Fetal Deaths

Treatment	Early Fetal Deaths (n)	Late Fetal Deaths (n)
Control	12	8
30-minute exposure	8	5
60-minute exposure	10	6

75-minute exposure	14	9

Chi-square test was performed to determine if there were significant differences among the treatment groups in terms of early and late fetal deaths. The significance level was set at ($P < 0.05$.)

CONCLUSION According to the results, broiler-hatching eggs subjected to a field of magnets approximately thirty minutes prior to incubation produced chicks that were considerably more likely to emerge from the eggs, had reduced mortality rates, and weighed more than untreated-group chicks. There were no appreciable hatching quality increases in the 60-minute or 75-minute exposure groups. Furthermore, there were no significant differences in the average incubation period or chick health assessment among the treatment groups. These results suggest that a specific duration of magnetic field exposure, such as 30 minutes, can positively influence hatching outcomes in broiler production. Further investigations are necessary to elucidate the underlying mechanisms behind these effects and optimize the magnetic field exposure protocols for broiler hatching eggs in order to maximize productivity and overall hatchery performance.

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