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Effects of exposing chicken eggs to a cell phone in ''call'' position over the entire incubation period

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Abstract

The aim of the present study was to assess the effects of exposing fertile chicken eggs to a cell phone repeatedly calling a ten-digit number at 3-min intervals over the entire period of incubation. A pre-experiment was performed first to adjust incubation conditions in an experimental chamber devoid of metallic content and without automatic turning until the overall performance of hatchability was reproducible in the absence of the cell phone. The experimental period consisted of a series of 4 incubations referred to as ''replicates''. For each replicate, one batch of 60 eggs was exposed to the immediate environment ($\leq$25 cm) of a cell phone in the ''call'' position (exposed group), while another batch of 60 eggs, 1.5 m away from the exposed group and also in the incubation chamber, was exposed to a similar cell phone in the ''off'' position (sham group). For each replicate, 2 other groups each of 60 eggs were also incubated, one in a standard mini-incubator (''Control I'' group) and the second in a standard medium size incubator (''Control II'' group). Temperature, relative humidity and electromagnetic fields in the experimental chamber were permanently monitored over the entire experiment. A significantly higher percentage of embryo mortality was observed in the ''exposed'' compared to the ''sham'' group in 2 of the 4 replicates ($p < .05$). In comparison with control groups, additional embryo mortality in the exposed group occurred mainly between Days 9 and 12 of incubation but a causal relationship between the intensity of the electric field and embryo mortality could not be established.

Keywords: Embryo; Chicken; Cell phone; Mortality; Electromagnetic fields

1. Introduction

Cell phones have become extremely popular among adults, teenagers and children world wide but the question of their potentially harmful effects on somatic and germinal tissues in individuals at embryonic, pre-pubertal and adult stages remains a subject of serious debate among scientists, manufacturers, politicians and journalists. Interestingly, a great majority of experimental approaches used to date have focused on epidemiologic and case studies as well as on acute exposure to specific bands of ELF (extremely low frequency)-modulated RF (radiofrequency) fields in humans and rodents [1] but information regarding the consequences of prolonged exposure to GSM (global system for mobile-communication) mobile phones in non-mammalian species remain relatively scarce.

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Among the candidates easily accessible to assess the possible incidence of GSM cell phone exposure on embryonic tissues, the avian egg is of major interest as (a) it can be individually tested under a virtually unlimited number of experimental conditions, (b) environmental effects can be directly perceived and tested without interaction caused by maternal effects as in mammals, (c) the structure and physiological development of the avian embryo are well established and (d) it can be used and tested virtually anywhere.

Two studies based on observations performed with chicken embryos, demonstrated that embryo mortality in eggs permanently exposed to an EMF (electromagnetic field) from a GSM mobile phone during incubation reached 64% compared to 11% in controls [2] and 75% compared to 16% in controls [3] at hatching ($p < 0.05$).

The aim of this study was to use fertile chicken eggs as models to test the consequences of exposing embryos to cell phones on subsequent mortality during incubation.

2. Materials and methods

2.1. Biological materials

Chicken eggs stored for a maximum of 5 days after laying were purchased from a commercial chicken hatchery (Sicamen, 72 440 Volnay, France). Upon transportation, eggs were sanitized (formaldehyde vapor) and incubated as described below. They originated from sexually mature breeder hens (30–45 weeks of age) of a standard broiler breeder-type (Arbor Acres) laying eggs with a uniform whitish colored shell facilitating early candling procedures. Eggs were delivered at the beginning of each replicate (referred to as Rep. 1, 2, 3, 4).

2.2. Design and adjustment of incubation conditions (pre-experiment)

The experimental incubation chamber (height 2.00 m, width 1.20 m, depth 2.00 m) was built with 5-cm thick polystyrene/concrete sandwich plates devoid of metallic content (Fig. 1). Temperature was monitored electronically using microprocessor regulation adjusted to 37.8 ± 0.2 °C. For technical reasons (absence of automated vaporisation system in the chamber), the relative humidity (RH) from Days 1 to 18 was manually adjusted using 6 pre-dimensioned water containers placed at each extremity of the chamber. Additional humidity was provided from Day 19 to hatching using manually repeated water spraying 4 times a day. Air-flow was ensured by monitored ventilation of the chamber with a fan panel. However,

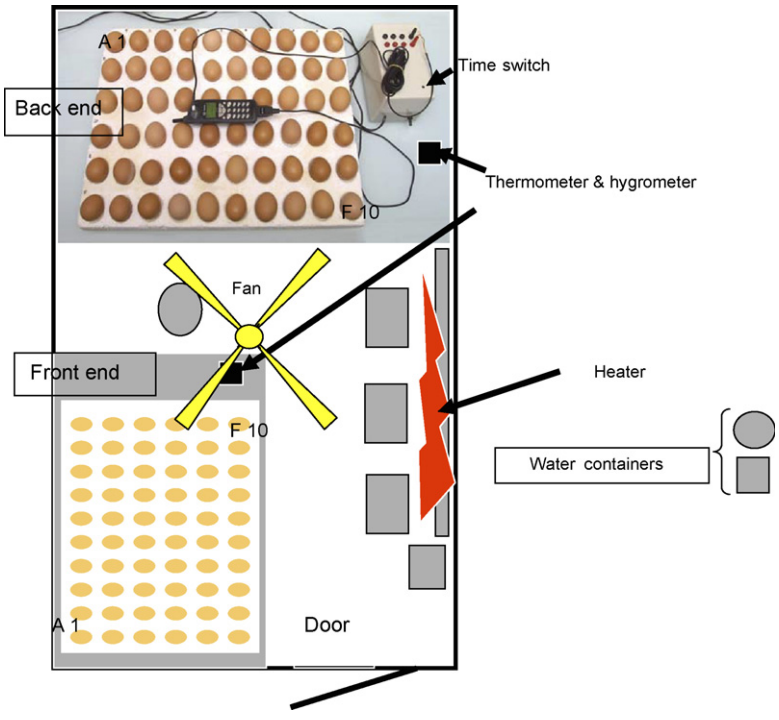

Fig. 1. Design of the experimental incubation chamber used. The dimension of the incubation chamber is 1.2 m × 2 m.