

**BIOEFFECTS OF CONTINUOUS EXPOSURE OF EMBRYOS AND YOUNG CHICKENS TO
ELF DISPLAYED BY DESK COMPUTERS: PROTECTIVE EFFECT OF TECNÓ AO
ANTENNA**

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We previously demonstrated that chicken immune and adrenocorticotropic systems synergistically respond to antigenic stress (1). Furthermore this answer is altered by continuous exposure of embryos and young chickens to ELF electromagnetic fields (2). Now we report the replication of a previous study (3) showing the efficiency of an electromagnetoprotective device termed TECNÓ AO antenna in preventing these bioeffects. TECNÓ AO antenna (8-12 Hz; 100-150 fT; patent registration number: PCT/FR 93/00546) is an autonomous magnetic oscillator made up of oscillating paramagnetic solution contained in a syntonised double antenna. The following parameters were assessed: embryonic and post-hatching mortality; plasma corticosterone and specific humoral immune responses to antigen challenge; body weight.

Incubation was carried out in a dark room heated at $38 \pm 1^\circ\text{C}$. Fertilized eggs were placed laterally 0.5-0.53m from a computer (Goupil G5 286 10) whose monitor's screen was hidden with a black tissue to avoid exposure to visible spectrum. The magnetic field intensity measured 0,5 in this area (computer switched off) was 26 nT for ELF and 19 nT for VLF. When the computer was switched on, the intensity was 565 nT for ELF and 38 nT for VLF.

Three groups of 30 eggs each were incubated and treated as follows: sham-exposed (control group) with computer switched off (CL); field-exposed group with computer on (IR); field-exposed group with computer on but equipped with TECNÓ AO antenna (IR+P). After hatching, the chicks from each group were continuously exposed until the age of 38 days under the irradiation schedule applied to the corresponding embryos. The mortality was evaluated at three day intervals during embryonic period and for one week after hatching. Young chickens were immunized subcutaneously three times with porcin thyroglobulin ($125 \mu\text{g}/100 \text{g bw}$) at the age of 21, 30 and 36 days; blood samples were collected at the age of 20, 29, 35 and 38 days and blinded. Serum titers of specific anti-thyroglobulin antibodies were determined by an indirect ELISA technique whereas plasma levels of corticosterone were measured by radiocompetition assay. All the animals were weighted on day 38. Statistical analysis was performed by the Mann-Whitney test for intergroup differences.

In the control group (CL; $n=17$), total mortality was 40%. After exposure to electromagnetic field (IR; $n=10$), the death rate reached 67%, but significantly dropped (56%) in the TECNÓ AO antenna protected group (IR+P; $n=12$). Irrespective of experimental groups, anti-thyroglobulin IgG titers increased throughout the experimental session until day 38: field-exposed chickens (IR) exhibited significantly lower titers of IgG ($10,175 \pm 3,437$) than their sham-exposed (CL: $122,500 \pm 17,128$) or TECNÓ AO protected (IR+P) counterparts whose antibody production were comparable ($151,458 \pm 29,964$). From the first to the third immunization, controls chickens exhibited progressively rising corticosterone levels reaching a maximum value on day 38 ($9 \pm 0.4 \text{ ng/ml}$). Conversely in the irradiated group, corticosterone concentration remained steadily low and was only 30% of control value on day 38 (4 ± 0.1). Hormonal response of the TECNÓ AO protected group was equivalent to that of controls ($9 \pm 0.6 \text{ ng/ml}$). Little intergroup discrepancies were observed in the general mean body weight, but striking sex differences were recorded with males appearing more sensitive to ELF than females. This data is in keeping with the previous one (3).

Taken together, these results suggest that continuously applied during embryonic and post-hatching periods, ELF issued from desk computers increase mortality, alter immune and endocrine responsiveness to antigen challenge and reduce body weight in chicken. Embryonic phase of development seems to be the most sensitive to ELF effects as witnessed by data reported elsewhere (4).

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