

## Chapter 73

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# Effect of Chromatotherapia on Audiogenic Seizures in Magnesium-deficient DBA/2 Mice: Preliminary Results

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### Summary

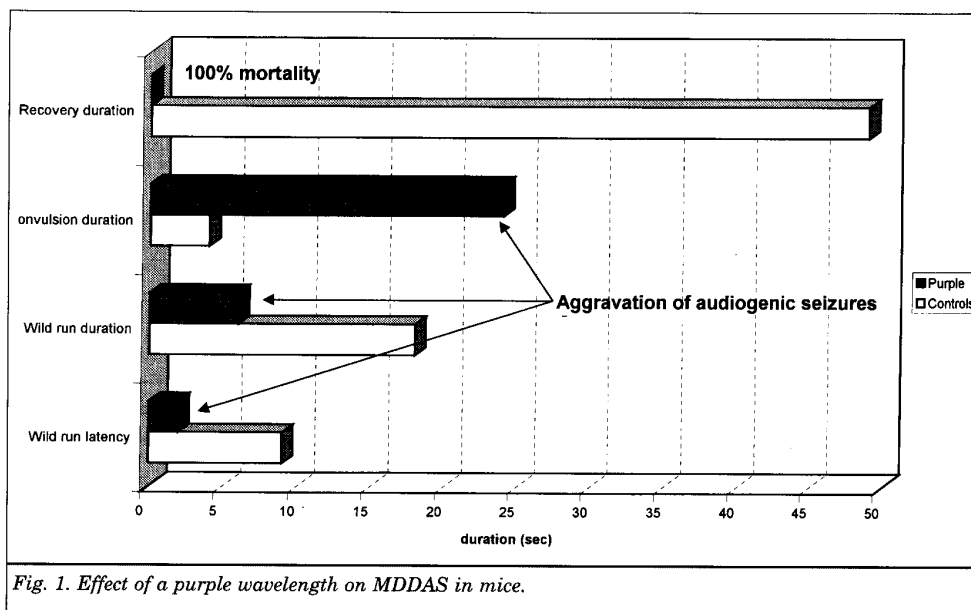
Audiogenic seizures triggered by an acoustic stimulus of determined frequency and amplitude have been described in many laboratory animals in various circumstances including magnesium deficiency. This model, recently validated, was used in DBA/2 mice to study the neuroprotective effect of two wavelengths of the visible spectrum used in chromatotherapia. It appears that a short exposure (50 s) to yellow (550–600 nm), followed by 20 min dark, fully protected nine out of 10 mice from seizure occurrence. On the contrary, a short exposure (50 s) to purple (peak 420–460 nm) aggravated the audiogenic seizures by accelerating the death of all the mice. These results, even though surprising but taking into account the energetic cell function, open a great field of investigations.

**Key words:** Magnesium deficiency, seizure, chromatotherapia, neuroprotection, neurotoxicity, phototherapia.

### Introduction

Magnesium deficiency offers an interesting animal model, since in adult DBA/2 mice strain, fed 21 days a 50 mg/kg magnesium purified diet, a generalized seizure episode may be induced by audiogenic stimulus. We recently documented the general characteristics of audiogenic seizures induced by magnesium deficiency<sup>(1)</sup> by measuring the duration of the different phases: latency and duration of wild running; then durations of seizures and recovery if any. Increased excitatory aminoacid action and decreased efficacy of GABA have been attributed a key role in initiating audiogenic seizures. But other mechanisms are also probably involved such as changes in taurine or serotonin levels.<sup>(2)</sup>

The aim of the present work was to study the possible chromatotherapia efficiency on this model. Chromatotherapia effects would be linked to the energy brought by different wavelengths of the visible spectrum.<sup>(3)</sup> In the present assay, we studied the effect of a short exposure



(50 s) to purple (420–460 nm) and yellow (550–600 nm) wavelengths, on the occurrence and pattern of audiogenic seizures in magnesium-deficient adult male DBA/2 mice.

#### Material and methods

Throughout the experiment, male DBA/2 mice ( $20 \pm 2$  g) were given either magnesium-deficient or standard magnesium containing food, i.e.  $50 \pm 5$  ppm or  $1700 \pm 100$  ppm respectively, for 21 days.

- (1) Chromatotherapy: In a dark chamber, groups of five animals were subjected to 50 s of yellow (500–600 nm) or purple (420–460 nm) wavelengths. The cages were kept in the dark for an additional 20 min period.
- (2) Sound stimulation: The audiogenic seizures were initiated after the dark resting period as previously described<sup>(4)</sup> by the emission of a sinusoidal signal (10 kHz  $\pm$  100 Hz). The sound intensity of 70 dBA was delivered for 15 s. During the audiogenic assay, only one mouse was present in the experimental field.

*Statistical analysis:* Normal distribution was assessed according to Shapiro Wilk's test. Statistical significance was calculated by analysis of variance (ANOVA).

#### Results

To calibrate the present assay, standard test conditions (10 kHz, 70 dBA, 15 s) were applied to five deficient and five non-deficient magnesium mice. The deficient mice showed a severe convulsive pattern, consecutively to audiogenic seizures, whereas the five non-deficient did not exhibit sign of neuroexcitability. A 50 s yellow lightening of the magnesium-deficient mice resulted in a relaxing effect immediately observable. In addition, nine mice among 10 ( $P < 0.001$ ) were fully protected from audiogenic seizure occurrence. One developed fatal audiogenic seizures. In contrast, the purple color aggravated the consequence of magnesium deficiency, by shortening the wild running stages leading to the precipitated death of all the nine studied

mice ( $P < 0.001$ ) (Fig. 1). Interestingly, five non-magnesium-deficient mice, when lightened with purple for 50 s did not develop audiogenic seizures.

### Discussion

Audiogenic seizures in magnesium-deficient mice are an interesting nutritional model of neurological disturbances. Magnesium ions appear to possess many properties that are potentially neuroprotective.<sup>(5,6)</sup> According to chromatotherapy theory<sup>(3)</sup> a physical energy brought by one wavelength could act as the energy brought by the corresponding trace element. A short (50 s) yellow exposure (or a longer exposure (8 min) to the complementary color, purple) would act 'as magnesium ions do'. Conversely a short purple exposure would act as a longer exposure to yellow. In the present paper, the two wavelengths were applied for a short time period (50 s). It is noteworthy that yellow and purple, applied for 50 s over the mice, resulted in significant ( $P < 0.001$ ) opposite – protective or aggravating – effects on audiogenic seizures respectively, 20 min after lightening. The purple wavelength aggravated really the audiogenic seizures triggered by the sound stimulation in magnesium-deficient mice since it was inefficient in control mice. The physiological effects of these interesting effects raise question of their impact on neurotransmitters and second messengers.

Clinical use of visible light (or some wavelengths) for 2–3 h was yet reported (phototherapy). It was used mainly, in the treatment of winter seasonal affective disorders, a pathology involving a dysfunction of serotonin and adrenergic systems and of biological melatonin-dependent rhythms.<sup>(7,8)</sup> Animal experimental exposure to different wavelengths resulted in altered melatonin levels, locomotor activity<sup>(9)</sup> or ovulation rhythms.<sup>(10)</sup> These effects were attributed to the presence of photoreceptors, identified first in the retina, then in the pineal gland and the deep brain<sup>(11)</sup> and involved in the nycthemeral rhythmic activities. Recently, they were also described in the skin.<sup>(12)</sup>

Our preliminary results, we called 'the Agrapart effect', obtained on audiogenic seizures in magnesium-deficient mice with a short (50 s) exposure to different visible wavelengths used in chromatotherapy were sufficiently interesting to be reported. This method taking into account the energetic aspect of cellular function, opens new fascinating perspectives in the field of experimental and clinical research.

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