

## Ultraviolet radiation emitted by lamps, TVs, tablets and computers: are there risks for the population?

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**Abstract:** The frequent human exposure to various types of indoor lamps, as well as other light sources (television monitors, tablets and computers), raises a question: are there risks for the population? In the present study the emission of UVA and UVB radiation by lamps and screens of electronic devices were measured in order to determine the safe distance between the emitting source and the individual. We concluded that the lamps and electronic devices do not emit ultraviolet radiation; so they pose no health risk for the population.

**Keywords:** Light; Radiation risks; Ultraviolet rays

Photoprotection has been increasingly discussed. The importance given to this subject has progressively increased since the publication of the first studies that associated ultraviolet radiation (UV) with carcinogenesis and photoaging.<sup>1,2</sup>

The first investigations on UV emitted by artificial source aimed at clarifying the relationship between the use of fluorescent lamps and the incidence of cutaneous melanoma.<sup>3</sup> Since then, there has been a growing concern with the possibility of increased risk for skin cancer in individuals exposed to indoor lamps.

In 1990, Diffey indicated the main situations of risk for UV radiation presented by artificial sources: artificial tanning chambers, medical and dental phototherapy, industrial photoprocesses, sterilization and disinfection, laboratory investigations, insect traps and indoor lamps in general.<sup>4</sup>

Later on there was research about radiation emitted by halogen lamps, as well as about exacerbation of photosensitive dermatoses after exposure to artificial sources.<sup>5</sup> After demonstrating that proximity to the emitting source would increase the risk for these dermatoses, the *Artificial Optical Radiation Directive*, formulated by the European Parliament, recommended that occupational exposure to UV radiation be limited to the effective irradiation of 1 mW/m<sup>2</sup> in an 8h period.<sup>6</sup>

It has already been demonstrated that all lamps emit UV radiation, whether they are quartz halogen, tungsten filament incandescent, tube fluorescent or compact fluorescent (mainly the latter).<sup>6</sup> However, the plastic materials used as light diffusers could block the passage of radiation.<sup>7,8</sup>

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Another point to be mentioned is that, currently, in every continent, discussions regarding the rational use of energy are increasingly frequent and a priority in government agendas. In this scenario, the tungsten filament incandescent lamps (common) are being replaced, both for residential and for commercial use, by compact fluorescent lamps, due to their low energy consumption.<sup>6</sup>

As most individuals are exposed to the most varied types of lamps used indoors, as well as to other light sources, such as TV monitors, tablets and computers, it is important to determine the radiation levels emitted by them and the safe distance to be kept between the emitting source and the individual.

With the objective of quantifying the emission of UVA and UVB radiation by different light sources used in a residential environment, a selection was made of the most used lamp types and brands in the Brazilian market:

- incandescent (Philips Soft 60W, Philips Standard 100W, Osram 60W, Osram 100W)
- compact fluorescent (Taschibra, Philips, Osram);
- tube fluorescent (Philips; Osram);
- halogen (Osram).

The following products were also evaluated:

- television (Samsung *Full HD Plasma*, Panasonic *LED Flat*)
- computers (LG *Microcomputer HD 500GB*, LG *Notebook HD 320GB* and Sony *LED 1TB*)
- tablet (Apple *Ipad 2*).

The emissions of UVA and UVB radiation by the several lamps and screens of electronic devices were measured at 5cm and 20 cm distance from the source. In order to do that, 2 photometer brands were used:

- UVA (320-400nm) and UVB (280-320nm) manufactured by Solarmeter (USA);
- UVA-400C (315-400nm) and UVB (280-320nm) manufactured by National Biological Corporation (USA).

Readings were taken 60 seconds after the sources began to operate, with the photometers at the measuring position for 15 seconds.

**Results:** In this study, there was no emission of ultraviolet radiation within the spectra considered UVA and UVB by the lamps and TV monitors, computer and tablet, independent from the variables: type, brand and distance (at 5 and 20 cm of distance from the source).

The results of previous studies on the theme are varied.

Whillock et al., in 1990, concluded that the UV emission of compact fluorescent lamps would not constitute a risk when at more than 65 cm of distance. In recent study on the same subject, however, it was found that those with a double envelope (encapsulated) offered greater protection. Furthermore, the glass present in the envelope also confers greater protection. Thus, even if the lamps emit a small quantity of UVB, this irradiation is totally blocked by the glass in them.<sup>9,10</sup>

Evidence from an experimental study revealed that fluorescent lamps, quartz halogen lamps and tungsten filament incandescent lamps may emit UVB waves with less than 280nm, and that larger doses of UVA could be emitted in more intense lighting.<sup>7</sup>

The analysis of studies published on the subject shows that none of them demonstrated detectable emission of UVA radiation (320-400nm). As regards UVB, the studies that evidenced detectable emission considered the spectrum from 280nm onward, and not the UVB 290-320nm range.

Published articles attempted to show the action of UV radiation in inducing photodermatoses, but the results are controversial, mainly regarding the spectrum and the quantity of UV radiation emitted by the lamps.<sup>6</sup>

As in this study there was no emission of radiation within the spectra considered UVB and UVA, it was concluded that the lamps and monitors of commonly used electronic devices do not emit ultraviolet radiation that poses a risk to the population. □

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