Protecting DNA Structure and Function: Effectiveness of Common UV Radiation Barriers

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The current study investigated the effectiveness of UV protection strategies – avobenzone based sunscreen (A), zinc oxide based sunscreen (Z), untreated cloth, SunGuard™ treated cloth UV protectant (TC) and combinations of sunscreens and cloths- in preventing DNA structural and functional damage. pGLO plasmid DNA was exposed to UV light for 10 or 20 minutes through the barriers listed above. The controls were no UV exposure and 10 or 20 minutes of exposure with no barrier. Structural damage (nicking) to the plasmid DNA was estimated using visual inspection of bands obtained on 1% agarose gels containing ethidium bromide. Functional DNA damage was studied directly by looking at the success of the pGLO plasmids in transforming JM109 E coli. In the 20-minute exposure, Z, A and UC alone resulted in no higher transformation success than with no barrier at all, while the TC gave significantly higher protection than the other individual treatments. ATC (A+TC) gave significantly higher UV radiation protection than the other treatments. In the 10-minute exposure, Z provided no more protection than no sunscreen at all. While the other individual barriers resulted in successful transformations. Unlike the 20-minute exposure, the transformation success was not significantly different between the UC and TC, but both were higher than A. In addition, all combination barriers provided stronger protection than the individual barriers as the transformation successes were significantly higher. Combinations containing A tended to result in higher transformation success than Z containing combinations. These results reinforce the idea that no UV exposure is the best protection against UV damage but if exposure is unavoidable, layering protections is best.